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ARTILLERY EXPERIMENTS AT SPEZIA.

Spezia has been again the scene of the most costly and gigantic experiments in guns and armor. For the purpose of determining the best material for the armor plates for the new Italian monster iron clads Italia and Lepanto, solid plates of 19 inches thickness have been submitted to the firing of one of the nine 100-ton muzzle-loading Armstrong guns, their firing charge being reduced for the purpose of giving the plates fair play at close quarters and with repeated blows.

The interest of the experiment consisted in the fact that the plates were either wholly of steel or steel faced. The targets were, of course, destroyed, but not without offering a resistance which renders it very doubtful indeed whether this country can safely decline to go forward in the costly struggle between guns and plates; for the steel plate, measuring 10 feet 10 inches by 8 feet 7 inches, received blows in all equal to 122,300 foot tons energy before complete destruction, while a shot from our 43-ton gun is credited, at the outside, with only 23,320 foot tons energy.

But perhaps the more interesting experiments were those which followed. They consisted, says the *Illustrated London News*, in firing eighteen rounds from the new 100-ton breech-loading Armstrong gun. This gun very far exceeds in power any gun ever yet produced, and has already been fired with charges greater by not less than 200 pounds than any charge hitherto fired. Of the eighteen rounds three were with 771 pounds of powder and 2,000 pound shot. The velocity given to the shot was 1,834 feet per second, and the energy resulting amounted to 46,700 foot tons, sufficient, that is to say, to lift the gun itself nearly 500 feet, or to penetrate thirty inches of wrought iron plate.

This great weapon presents many new features of interest. It has no trunnions, but lies in a brass saddle or cradle, so narrow that the two guns of the turret lie close side by side, like a double barreled gun. The breech is opened and closed by hydraulic mechanism, not attached to the gun, so as to maintain perfect simplicity and solidity in the gun itself. And the gun is so mounted through means of hydraulic appliances that, when in the turret, the gun fills up the port, thus excluding all enemy's shots.

In the experiments at Spezia the gun was not mounted in a turret, but on a pontoon, built for the purpose. It was loaded and worked, however, by the mechanism to be used in the turret, and precisely as it will be on board ship. It was found that one man can accomplish all the movements required for the loading and aiming of the gun with ease and rapidity. No difficulty or hitch of any kind occurred in these extraordinary experiments. The working of the gun and machinery exceeded all expectation, and the Italian officials are in the highest degree gratified at the brilliant success attending their almost audacious enterprise.

The experiments have a great interest for this country, apart from the circumstance that the gun and machinery are of English invention and production. It is well known that the whole of the machinery and appliances originated with Mr. George Rendel, now a Lord of the Admiralty, who, with Mr. Barnaby, C.B., was present on the part of our authorities. Moreover, the whole of the 43-ton breech-loading guns to be mounted on all the new British iron clads are to be mounted and worked in precisely the same manner as the Italian monster gun. As the greater must include the less in such matters, the success of the present experiments guarantees that of our own intended mode of mounting and working heavy guns.

The only subject for regret, perhaps, is that we have not the security these experiments assure to Italy in respect of the gun. The Woolwich 43-ton gun will, no doubt, be a close reproduction of the new type Armstrong guns. But at the very best it cannot hope to achieve half the penetrative power of the Italian gun as against wrought iron plates; and as against the new steel plates, which, it appears, must be battered to pieces rather than penetrated, its power will probably fall much short of half.

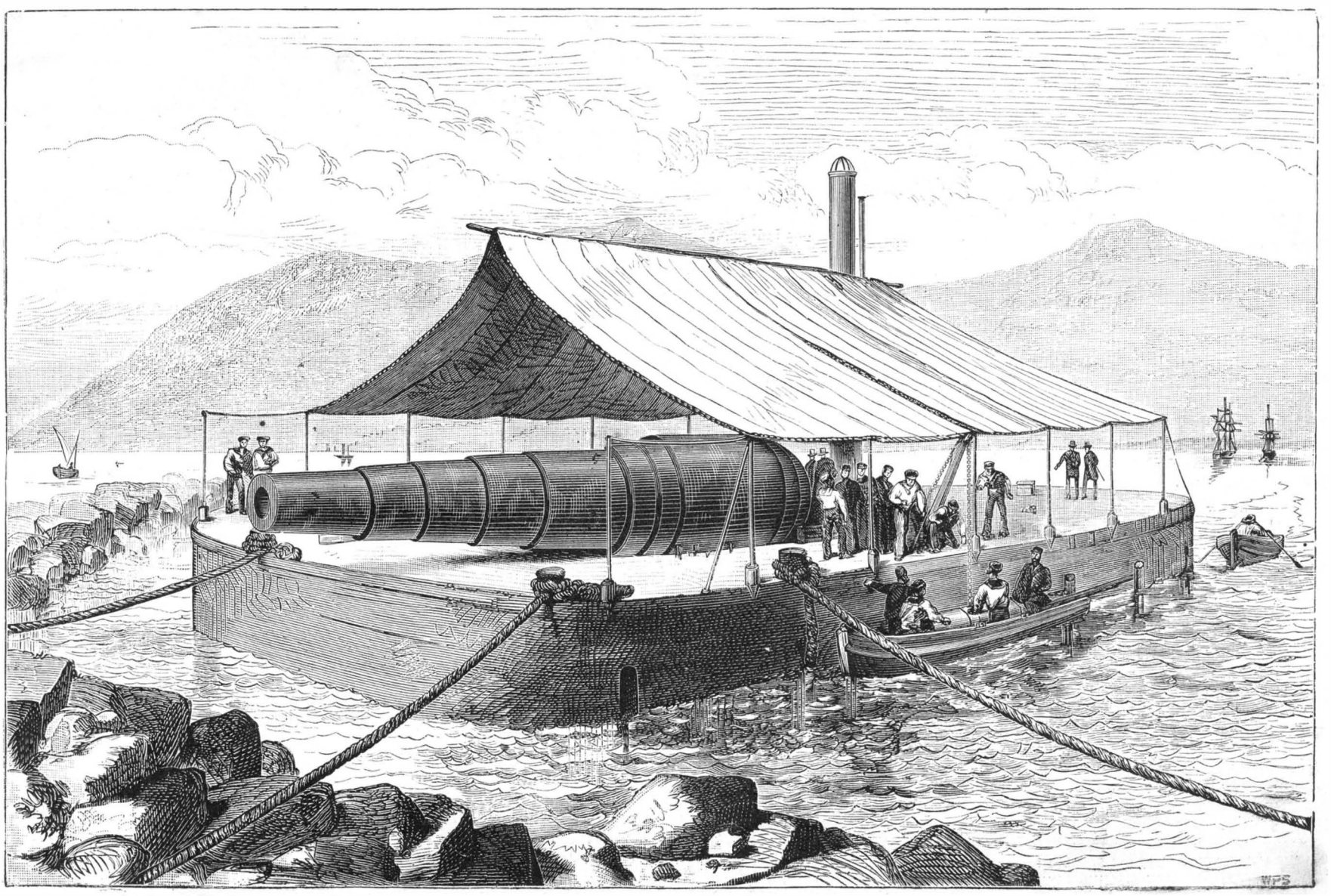
It is perfectly idle for the authorities of this country to attempt to regulate the advance of artillery to suit conveniences of manufacture, or the state of official invention, or difficulty of obtaining money. They cannot say to the gun or plate maker, "Thus far, and no farther," any more than Canute to the tide. We have four 80 ton guns afloat, against the eight Italian 100-ton guns; but the power of the eight new breech-loading guns now built or building for Italy at Elswick, and of which the sample has now met with such unqualified success, is in excess by 50 per cent of that of our 80-ton gun; the one being 30,000 foot tons and the other 46,700 foot tons.

Public Use and Sale prior to Grant of the Patent.

In the case of Alteneck, on appeal from the Commissioner of Patents, the Supreme Court of the District of Columbia holds that an application for a patent cannot be rejected on the ground that the invention was in public use and on sale for more than two years before the time of filing the application, when the only proof before the Commissioner consists of mere *ex parte* affidavits taken without notice and cross-examination. The law confers upon the Commissioner authority to institute an inquiry into allegations of public use and sale of the invention, such as would bar the patent. This proceeding, on which the Commissioner acquires his information through the testimony of others, is a kind of judicial inquiry, and when the testimony is furnished by those in adverse interest, it becomes substantially a contest, and in such case justice requires that the fate of the application be determined by proof which conforms to the fundamental canons of the law of evidence, according to which *ex parte* affidavits, taken without opportunity to cross-examine, are in no case admissible upon the merits of a cause.

Electric Motors in Mines.

A novel application of the electrical transmission of power has been made at the Trafalgar Collieries, Forest of Dean, England. A pump in the underground workings is driven by an electric motor, the current, generated by a dynamo machine at the surface, being led down the shaft and along the workings a distance of 500 yards. The drainage water of the deep workings is raised by the electric pump 115 feet vertically and forced through 500 yards of piping to the bottom of the shaft, whence it is raised by steam pumps to the surface of the ground. The working of the electric pump is said to be very satisfactory.



THE GREAT ITALIAN GUN LATELY TRIED AT SPEZIA.

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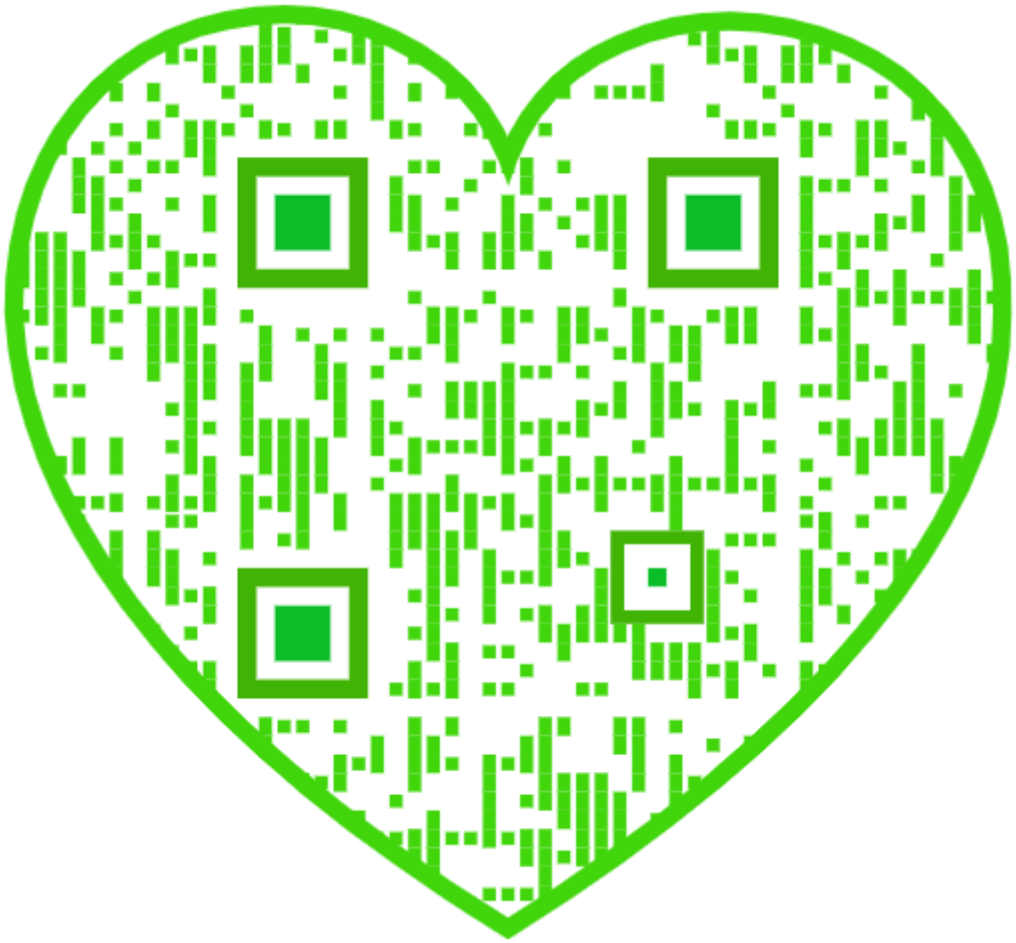

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THE CARE OF THE INSANE.

The annual meeting of the National Association for the Protection of the Insane and the Prevention of Insanity was held in Philadelphia Jan. 25, Dr. Joseph Parish of Burlington, New Jersey, in the chair. The address of welcome was read by Prof. Samuel D. Gross, of the local committee. It was followed by the reading of essays by Prof. Traill Green, M.D., of Easton, Pa, on the functions of a medical staff of an insane asylum; by Prof. J. S. Jewell, M.D., of Chicago, on preventable causes of insanity; by Dr. Joseph Parrish, on how to protect the insane; and an address on the duty of medical colleges and the general practitioner toward the mental and nervous diseases, by Dr. Charles K. Mills of Philadelphia.

In the evening Rev. R. Heber Newton of New York spoke of the obligations of the sane toward the insane, and the need of new safeguards to the sane as well as to the insane. Dr. H. Marion Sims, of New York, read a paper on the prevention of insanity in certain cases of nervous and hysterical women, in which he insisted on the necessity of more critically distinguishing cases of insanity from those of the delirium of acute disease.

As an example of failure in this respect he cited the case of Horace Greeley, who was sent to an insane asylum, where he speedily died, because of delirium due to acute meningitis or cerebro-spinal meningitis. There was just as much reason, he said, for sending a case of typhoid fever, with delirium, to an insane asylum. A paper on the legal rights of the insane and their enforcement was read by Clark Bell, Esq., President of the New York Medico-Legal Society; and one on the prevention of insanity by the rational treatment of inebriety, by Dr. T. D. Crothers, of Connecticut. Important and timely papers were also presented from half a dozen foreign alienists.

Dr. J. Milner Fothergill, of London, discussed the influence of perverted assimilation in producing insanity; Drs. A. Baer, and Norman Kerr, of the same city, considered the connection between inebriety and insanity; Dr. Jas. Lalor, of Dublin, discussed the value of systematic education as a means of curing insanity; Dr. Charles Mercier, of London, contributed a paper on some of the conditions of life which influence the production of insanity; and Dr. Wm. Julius Mickle, of London, a note on the prevention of some cases of cerebral and mental disease, produced by cranial injury.

PROGRESS IN MEDICAL ETHICS.

The discussion of the revised code of medical ethics at the special meeting of the New York County Medical Society the other evening, and the strong vote in favor of allowing consultation with any legally qualified practitioner, are hopeful indications of decreasing dogmatism on the part of that school of physicians whose opposition to exclusive medical dogmas has hitherto been so rigorously dogmatic.

The special feature of the new code, which was adopted by the State Medical Society last year, and which has aroused so much opposition throughout the country, lies in the following rule:

"Members of the Medical Society of the State of New York, and of the medical societies in affiliation therewith, may meet in consultation legally qualified practitioners of medicine; emergencies may occur in which all restrictions should, in the judgment of the practitioner, yield to the demands of humanity."

The opponents of this rule protest that it substantially puts the "regular" physician—that sole embodiment of medical science and sincerity—upon a level with homœopaths and quacks and all who have been led astray by false dogmas and given over to abhorrent practices. "Why," exclaimed one indignant conservative, "have they (the State Medical Society) passed this law, which is obnoxious to the entire profession? It is an outrage. Are we going to allow everybody to come into our profession and recognize them as practitioners? That is what this rule practically amounts to."

The issue of the meeting happily showed that a portion, a very capable and successful portion, of the entire profession do not so regard it. The law of the land determines who shall or shall not practice medicine; and the question of consultation between those on the same legal footing may safely be left to the intelligence and honesty of the independent practitioner. As Dr. Fordyce Barker put it, the physician who requires to be directed how to behave is not fit to be a practitioner. "Exclusive dogmas," he said "are not confined to the homœopathic school. They are found among many who belong to the old school, and many of these 'exclusive dogmas' are far more dangerous than those of the honest homœopathists. We are meeting with exclusive dogmas in the profession constantly, and these dogmas are generally a 'rejection of the accumulated experience of physicians,' to quote the old code."

Defending the amended code, Dr. C. R. Agnew said: "My position is simply this: I believe in meeting error with the truth, and not with persecution. From some of the things which have been said here to-night, one might suppose that we were living in the first half of the seventeenth century. Error never has been and never can be destroyed by persecution. I advocate the new code because it is in keeping with the refined ethics of the time in which we live. Nothing could be safer than the new rule governing consultations. When the old code came into existence there were, perhaps, a score of homœopaths in this country; now there are fully 6,000. What has persecution done to defeat error here? You cannot re-enact the old proscriptive, trades union code, if you want to. It is a dead letter like the Fugitive Slave Law, and this society should recognize the fact."

The society did recognize the fact by a vote of 135 to 43 in favor of the new code.

Naturally, in the ranks of the opponents of the advance were numbered not a few of our oldest and most honored physicians. They are not likely to outgrow their early prejudices. On the other hand, the leaven of liberty appears to work most strongly among our leading specialists. It is a credit to the regular physicians of New York State that they have taken the lead in this proper and inevitable reform; and those physicians of this city who did so much to determine the action of the State Society are to be congratulated upon their success in bringing their local society up to the same level.

A SNAKE TRAP WANTED.

The destruction of human life in India by venomous snakes is appalling, and the number of cattle killed by them is a serious drain upon the resources of the people. In Bengal alone about 10,000 persons are fatally bitten every year, and nearly as many more lives are lost by the same pests throughout British India. These are deaths officially registered. Sir Joseph Fayrer, the most competent living authority, believes that the reported deaths do not nearly include the whole number.

The cattle reported killed by snakes number between two and three thousand a year; also, in all probability, an under statement. Of late years considerable rewards have been offered for the killing of venomous snakes, and thousands have been destroyed, to the material lessening of the death rate of people and cattle; still the country is overrun with the pests, and is likely to be until better means have been devised for taking and destroying them.

In 1880 the deaths reported as from snake bite were 19,060; and 212,776 snakes were killed at a cost of over $4,500, in rewards. The next year (1881) there were fatally bitten 18,610 people; and 254,968 snakes were destroyed at a cost of nearly $5,000.

The snakes which do the mischief are, according to Fayrer, the cobra, the Bungarus cœruleus or krait, the echis, and the daboia or Russell's viper, all of which are most conspicuous snakes, and easily identified. There are others, such as Bungarus fasciatus, Ophiophagus elaps, which are dangerous, but comparatively rare, and seldom bite men, while the hydrophidæ, being confined to the sea or estuaries, are, though very poisonous, not so dangerous to man, and the trimeresuri, which are both uncommon and at the same time are not so deadly as to endanger life.

It is proposed that a corps of snake hunters shall be organized in every district, whose duty would be, under proper supervision, to seek out and destroy these pests. In several provinces gangs of paid snake hunters are already at work, with very encouraging results.

It appears that only kanjars or men of similar caste can engage in this work, the taking of life of any sort being a violation of the religious laws of most Hindoos. It is doubtful whether the snake killers will ever pursue their task, however well paid, with a degree of care and thoroughness likely to destroy their occupation. If the snakes are to be exterminated, it will have to be by other means.

Would it not be possible to devise traps in which snakes could be taken alive (by members of castes who could not kill them) to be turned over to proper authorities for destruction? Or traps might be made into which snakes could be enticed to their own destruction, traps which once set would go on performing their beneficent work endlessly, without the intervention of a caste ridden people, and without putting upon any one but the trap setter responsibility for taking life.

The scope for invention in this direction is very wide; and in view of the circumstance that the patent laws of India are quite favorable to inventors, and the fact already noted that the general government and several local governments have seriously undertaken the work of ridding the country of deadly snakes, and are spending large sums for the purpose, it is clear that a simple, cheap, and efficient snake trap would find a ready market there. If a trap could be produced that people of all castes could be induced to use, its success would be enormous. There are 200,000,000 people in British India alone that need such protection.

Giving Notice of the Patent.

Judge Wallace, in the recent case of the New York Pharmical Association *vs.* Tilden, decides that patentees are required to give "sufficient notice to the public" that the article is patented, "together with the day and year the patent was granted," by stamping or labeling the article. Where this has not been done, it is a fair interpretation to hold that when any equivalent notice has been given, the defendant has been "duly notified" within the meaning of section 4,900 Revised Statutes.

As the sufficient notice prescribed includes a specification of when the patent was granted, it is reasonable to conclude that any notice, verbal or written, that includes this information will suffice.

As to proving the signature to an assignment, the court held that assignments of patents duly acknowledged before a notary are sufficiently proved, and it is not incumbent upon the complainant to prove the signatures of the assignors.

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HOW STEAM ENGINE VALVES ARE FINISHED.

Scraping for fits in the machine shop, is quite modern. It is the present practice to make all rubbing fits, of whatever form, by scraping. Formerly fits were made by grinding the two moving surfaces together after planing, or turning, and filing. Emery and oil were used on iron and sand and water on brass. There were two serious objections to this method. One was that the sharp particles of emery or sand would become embedded in the metal and continue the grinding or cutting operation long after it should have ceased; and another was that by grinding the two surfaces together each imparted to the other its imperfections, the protuberance on one producing a corresponding depression on the other, thus perpetuating the evil the process was intended to remedy, if not to remove.

Of late years a finished fitter is expected to understand practically the work of scraping, and to know the use of the surface plate and straight edge Steam valves especially are fitted in no other way than by scraping.

The usual method of making a fit by scraping is to coat the two surfaces which are ultimately to work together with red lead thinned with oil, and then rub them together. Wherever the bearing comes, there the paint is removed and the scraper should be applied. But there are objections to the use of this pigment, as gradually it fills the pores of the metal and reduces the entire surface to a dull reddish gray color not admitting of any shading. A better method and material is a quick wipe over with a rag saturated with spirits of turpentine. After rubbing, the salient points will show bright, while a dry film will remain in the hollows. The surface will always remain clean, and no change of color will occur during the entire process of scraping.

It is obvious to the least consideration that the fitting of two rubbing surfaces at the usual heat of the atmosphere and their fit under a very much higher temperature may not be uniform, especially if the mass of one of the moving bodies is much greater than that of the other, as in a valve and a steam chest.

Here then was a puzzle; how to make a cold scraped fit be also a fit under steam temperature. When it is considered that 70° may be considered general shop temperature, and that 65 pounds pressure of steam is about 316° temperature, it is evident that here is room for apprehension that a scraped fit of steam valves under ordinary circumstances would not be a good fit under working circumstances. And so it has proved in experiments.

A test was carefully made on the main valves of a new engine. The valves were scraped to a *perfect* fit—perfect humanly speaking—and tested by air at the normal temperature. They were tight. Then steam was let on, and in a short time the valves leaked a perfect sheet of steam.

The main valves of steam engines are now tested—and marked for scraping—by steam at full pressure. At least this is the practice at the Hartford (Conn.) Engineering Company's Works. A pipe is led from the boiler to the cylinder and steam chest of an engine "in progress;" the steam chest is temporarily covered in, the valves, valve rod, and necessary appurtenances in place. The valve rod is attached to an adjustable slotted arm, set to represent the traverse of the valve for that particular engine, the arm or crank being fixed to a shaft with belt and pulley driven by a countershaft Steam is let on, the valve set in motion, and run for a few minutes. When the steam is shut off and the valves removed, it is found that the steam heat and the rubbing has shown the places of bearing as well as would the red lead or the turpentine cold, and two expert scrapers go at the faces of the valves while they are still hot. The final result is as near perfection as human skill can expect.

The Pressure of Gaseous Explosions.

MM. Mallard and Le Chatelier have contributed to the *Comptes Rendus* a note upon the instantaneous pressures produced during the combustion of gaseous mixtures. According to observations made by these experimentalists upon explosions of gas in long tubes, when a flame is propagated along a pipe containing a combustible gaseous mixture, there is a development of great pressure, which only lasts during a very short time. A pressure that will pulverize a glass tube three centimeters in diameter and three millimeters thick, so that the fragments shall be less than a millimeter in size, must be enormous; but the apparatus at the disposal of the experimentalists has not enabled them to measure it.

It has been ascertained, however, that the shock is of extremely short duration. Photographs of an explosion under these conditions show that the ignited luminous gas is projected to a distance of three meters from the end of the tube in less than the one-thousandth of a second. The maximum pressure cannot exist longer than a few thousandths of a second. A similar effect has recently been found to attend an explosion of gas in a closed vessel. It has been discovered that the pressure obtained under these circumstances far exceeds, for a short time, that due to the temperature of combustion.

With a mixture of oxygen and hydrogen the shock exceeded by more than nine atmospheres the normal pressure due to the heat of combustion, although this excess was obtained only during a period of less than the ten-thousandth part of a second. This phenomenon is only observed with explosions of quickly burning mixtures, such as light carbureted hydrogen and hydrogen with oxygen. Mixtures of light carbureted hydrogen and carbonic oxide with air do not appear to give rise to the effect in question. The cause of the abnormal pressure is accounted for by the hypothesis that the explosive mixture takes fire by layers, and that the explosion of the first layer compresses the second just before it is ignited. This excess of pressure would produce an augmentation of temperature which would be repeated in the next layer, and so on until the maximum is reached. The reasonableness of this supposition is apparently confirmed by the discovery of the "explosion wave" by MM. Berthelot and Vieille. It is believed by MM. Mallard and Le Chatelier that the explosion of a mixture of hydrogen and oxygen by successive layers may bring up the maximum shock to one hundred atmospheres; but as it only endures for perhaps the millionth part of a second, the effect of this pressure on a movable or elastic body would be inappreciable.

Forging a Rudder for the Steamer City of Berlin.

The rudder of the City of Berlin was carried away in a recent storm, and a new one was forged at the works of the Paterson Iron Company. The superintendent of the works described the job as the largest of the kind ever undertaken here. "The shaft is forty feet long," he said to a *Sun* reporter, "the blade is twenty-five feet long, and the shape of the whole is so irregular that we have to put on counterweights every time it is handled in order to run it over under the hammer. It will weigh about nine tons. The blade is made of sheet iron plates, bolted on each side of the frame. The frame is made of iron about eight inches square. The open space between the two plates forming the blade is sometimes filled in with resin. This, when melted and poured in, forms the most durable and solid filling. Some, however, use plaster of Paris. Others fill in the space with wood. Finally, others perforate the plates and let water run in. This is probably as good as anything. The frame gives the rudder the desired strength. The plates are only to give a surface. A rudder six feet broad will steer a steamship 400 feet long."

While the reporter was listening, the building was lighted with the brilliant glow of a red hot bow of iron about fifteen feet long and eight inches square, just taken from the furnace. It was in fact, a part of the outer rim of the curving rudder. In the mean time, a corresponding piece projecting from the rudder shaft, which had likewise been heated, was brought from a furnace to be welded on. The two ends that were brought together were like two letter Vees pointing toward each other, thus: ≻≺. Then several men with great tongs took from the fire two small pieces also shaped like letter Vees, made to fit on the space between the two ends to be welded. These smaller pieces, were held in place until a blow or two of the great hammer, giving a 4,000 pound stroke, caused the half melted masses to adhere. Next the whole mass was twisted and turned, and the blows rained faster and harder, until in a few minutes the weld was completed. A similar operation welded the other end of the bow to the post.

"A single false blow," said the superintendent, "might spoil the whole thing. A bit of dirt in it might make a flaw that would cost us thousands of dollars for damages. It takes a good mechanic to boss such a job, and we have to pay him good wages—$12 a day. He is the most important man in the shop."

Importance of Small Industries.

Speaking in Congress the other day of the need of encouraging certain relatively small industries, Senator Miller referred to the city of New York, the greatest manufacturing city in America—he might have said in the world—and "yet she has not a cotton mill, a blast furnace, or a rolling mill within her borders. Her manufactories are small," he said, "but they employ more than a quarter of a million people."

It is worthy of notice in this connection that while recent patents have much to do with the means and methods of the great staple industries, such as steel and iron production, iron milling, cotton and woolen manufacture, and the like, the smaller yet in the aggregate immensely important industries are almost wholly based upon and due to the development of recently patented inventions.

Cork Shavings for Vinegar.

The wood shavings commonly employed in vinegar factories preserve their activity for a certain length of time, and then become useless. Bersch explains this on the supposition that the shavings becoming saturated with liquid, get heavier, and press down on those beneath so hard as to prevent the air from circulating through them. He therefore recommends the substitution of the waste cork from which stoppers, etc., have been cut, for the wood chips. The elasticity of the cork is increased by moisture, so that they cannot pack together even in the tallest tanks. Small organisms exist in the pores of the cork, and among these many vinegar bacteria, so that the cork is very active in making vinegar. P. N.

Bordeaux Red, a New Wine Color.

A new red substance that has been introduced for coloring wines, under the name of Bordeaux red, or *Rouge vegetal*, has been analyzed by Guichard, who reports (*Jour. de Pharm.*) that it is a naphthaline dye. It is said that one gramme (fifteen grains) is sufficient to color five liters of wine a deep red (three grains to the quart).

For the detection of this dye in wine, Thomas makes use of its action toward silk and ammonia. It dyes the silk a granite red, and is turned brown by ammonia.—*Polytech. Notizblatt.*

How to Fire Steam Boilers.

Young engineers, if not some more experienced ones, will find some useful hints on a very important subject in the following article from the *Milling World:*

By the application of a little skill and care, very unusual results may not unfrequently be attained by ingenious mechanics. This is especially the case with firing steam generators when the fuel used is salt coal or sawmill offal Careless firemen fill in the coal haphazard, as long as any can be got into the fire box, causing great volumes of dense, black, unconsumed smoke to issue from the stack, giving evidence to all who see it, and know anything about what is going on, that a large percentage of the fuel is being thrown broadcast into the air, not only wasting the money of the owner, and the labor of the fireman, but contaminating the atmosphere for the use and enjoyment of the public.

Nothing would seem to be more plain than that it is the duty of the fireman, for his own sake, if not for that of his employers, to use as little fuel and labor as possible, to do his duty a little better than any one else. To effect this, only a little care, combined with such knowledge and skill as may easily be acquired by any fireman, is necessary. In burning coal, the grates should be much nearer the bottom of the boilers than in burning sawmill offal, the fire should be much more spread out, and kept shallower, and in feeding coal the lumps should be well broken up to hickory nut size, and only a small quantity thrown on at once and well spread out, so that the flames may attack it on every side and thoroughly consume all the carbon and bitumen of which ordinary coal is composed. It is of vital importance that all the air needed to thoroughly burn the fuel up should be applied under the grate as directly as possible, and as hot as it can be made. Not a little of the waste in fuel is caused by too much air passing through the furnace in various ways, all of which consume heat in unnecessary quantity. The furnace walls should be as near airtight as possible, and no useless air should be allowed access except through the proper spaces, otherwise the draught is injured and much of the fuel is wasted.

The back ends of the grate bars ought to be several inches lower than the front, that the air going up to consume the fuel may not meet with so short a curve. It is also best, in many cases, to leave the ashes banked up in the back of the ash pit and at the sides, that the air currents may be concentrated into a steady stream, carefully avoiding all eddies. The best method for each separate furnace can only be ascertained by trial and experimental tests, which the fireman must make for himself, and which he will be sure to do if he wishes to excel in his business.

A fire room should always be kept closed up tight, be kept as hot as possible, and free from cold air currents and blasts. It is very poor economy to spend labor and fuel to make steam only to condense and lose it before it is used. The boilers ought to be completely covered with an air and heat tight casing. Formerly it was supposed that the boiler would be injured if the flames had access to the steam space in the upper part above the water, but this has long ago been proved to be a great mistake. Where the boilers are fired inside, mineral wool covered over the exterior flagged with wood or metal is excellent as long as it is kept dry. A boiler thus covered can be touched by the hand without any unusual or uncomfortable heat being experienced. Even in warm climates, boilers ought always to be well protected under weatherproof sheds or buildings covering up perfectly tight all the rear parts, even using a bulkhead or partition just at the front, outside of which the fireman may stand if the heat is too much for him. It must stand to reason that a boiler room cannot be made too hot, or kept so, for economy and efficiency. How to do so cheapest and easiest, is the problem which both employer and operator should unite in striving to attain.

Not long ago the writer saw a portable engine at a fair, that burned only 2¼ lb. of coal per horse power an hour. The coal was broken up chestnut size, screened and washed, and fed into the furnace a pound at a time, being carefully spread over the bed of glowing fuel in the fire box. No smoke could be seen issuing from the stack, and the object, that of entirely consuming the fuel, seemed to be attained. But this is not practicable in ordinary use, though it may be approximated more nearly than it is, in almost every case.

The use of steam in very minute jets in front of the fire box inside may be made to contribute largely toward heating up furnaces and consuming smoke, when intelligently and skillfully used. But when applied in excess it dampens down a fire and does much more harm than good.,

Water, it is well known, is composed of two highly combustible gases, oxygen and hydrogen. When steam is injected into a very hot fire, the water of which it is composed is decomposed, or separated into these gases, which add greatly to the heat of the furnace.

These suggestions are made largely for the attention of firemen and engineers, who can readily see what a margin for improvement is before them.

The Manufacture of Bessemer Steel.

Official statistics show that the production of Bessemer steel ingots in the United States last year was 1,696,450 tons, being an increase over 1881 of 10 per cent. The quantity of Bessemer steel rails produced in 1882 by the fourteen completed works was 1,334,349 tons, and an increase of 6 per cent as compared with that of 1881. These figures do not cover rails made from imported steel blooms and open hearth steel rails.

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THE LAMBERTVILLE IRON WORKS AUTOMATIC CUT-OFF ENGINE.

We give herewith illustrations of the Lambertville Iron Works automatic cut-off engine, constructed by Mr. A. Welch, Lambertville Iron Works, Lambertville, N. J., in which Fig. 1 is a perspective view of the engine, Fig. 2 is an indicator diagram, and Figs. 4 and 5 are elevations of the governor and attachments. Fig. 3 is a sectional plan of cylinder and valves.

The main valve, A, is of the long D slide valve type, with multiple ports at the ends through which the steam enters the cylinder. It is operated from an eccentric on the crank shaft in the usual manner, giving a positive lead and exhaust without regard to the point of cut-off. The cut-off valve, B, is operated also from the motion of an eccentric upon the crank shaft. The rod or stem, E, of the cut-off valve passes through the main valve rod, O, and slide, S. Upon its outer end are tappets, Fig. 3, which engage with corresponding tappets attached to the cut-off eccentric rod, which is pivoted to and supported centrally between the tappets by the rock arm, M, the opposite end of the rock arm having motion upon a pin or bearing in the governor slide, which is adjusted to position, up or down, by the action of the cam operated by the governor balls. The slide, S, is of cylindrical form, and incloses a spring and dash pots with disks attached to the cut-off valve rod, by means of which the valve is closed. The motion from the two eccentrics for operating the valves is relatively in the same direction, but of different strokes, that of the cut-off being greater by an amount necessary to open the multiple ports, and also with sufficient angular advance to cause the ports to be well open for the admission of steam when the engine is on its center, so that no loss is occasioned by wire drawing of the steam even at the shortest point of cut-off.

It will be seen, by reference to the foregoing description, that as the cut-off valve is opened by the tappets, the spring will be compressed to an amount equal to the difference in the strokes of the eccentrics, and that so long as the governor balls are in their lowest position the tappets will be in contact, and that no release or tripping will take place, the engine working precisely as a plain slide valve engine while this continues. It will also be seen that as the speed of the engine increases, the centrifugal force of the governor balls will lift the tappets apart until a release occurs, when the valve will be instantly closed by the reaction of the spring, and the two valves will then move together as one valve for the balance of the stroke. This operation may take place at any part of the stroke indicated by the governor.

There are two principal types of automatic engines, one being the releasing type, the other the positive type. In the releasing type the valve is closed instantly by a spring or weight, the cut-off being sharp and well defined. In the other type the cut-off valve has positive connection with an eccentric, the throw or lead of which determines the point of cut-off; and as the valve has a constant gradual motion, the cut-off is not so prompt and the steam is wire drawn, as shown by the rounded corner of the indicator diagram.

In the releasing type the governor is usually of the ordinary fly ball pattern, and has only to define the point of cut-off, which it is free to do during a greater part of the stroke, and as the adjustment required is extremely small, a high degree of sensitiveness and almost perfect regularity of speed are secured.

In the other type the governor, placed on the crank shaft, consists of weights, the centrifugal force of which is at an equilibrium with springs for the desired speed. By this arrangement, where the cut-off valve is unbalanced there are but two brief moments in each revolution where an adjustment of the weights and springs can take place should a change of speed occur; and as the amount of adjustment required is comparatively great, the regulation is correspondingly difficult and imperfect. For this reason, to increase its sensitiveness and obtain a better regulation, it has been found advisable to run engines of this class at a much higher speed than has been possible with the releasing type, the positive connection of its valve gear rendering it specially adapted for this purpose. The unsatisfactory performance of one class at a high speed, and the equally unsatisfactory performance of the other when run at a moderate rate of speed, forms the chief distinction in the performance of the two classes.

In the engine shown in the engraving, the valve gear, though nominally of the releasing type, and possessing all of its desirable qualities, including sharp cut off and close regulation, is also adapted to as high a speed as may be desired, as the relative motion of the valves is constant. The striking force of the tappets to open the cut-off valve is the same for all speeds, the contact being simply repeated with equal force a greater or less number of times per minute. The movement to open the valve is positive, and a failure impossible. For this reason the engine is equally well adapted to either high or low speed. This is a great advantage, as when an engine of this kind is found to be too small for its work, the speed may be increased so as to secure the required power, and the expense of a new engine will be saved.

Another noticeable feature of this valve gear is its wide range, the steam being cut off at any point from zero to full stroke, or as determined by the main valve. This is frequently very important, as in the case of rolling mills, and others, where the whole work is suddenly thrown on or off; the full power of this engine being under immediate control of the governor at all times, with but slight change of speed.

But, aside from the perfection of this valve gear as compared with others, the chief point of interest is its simplicity and free-

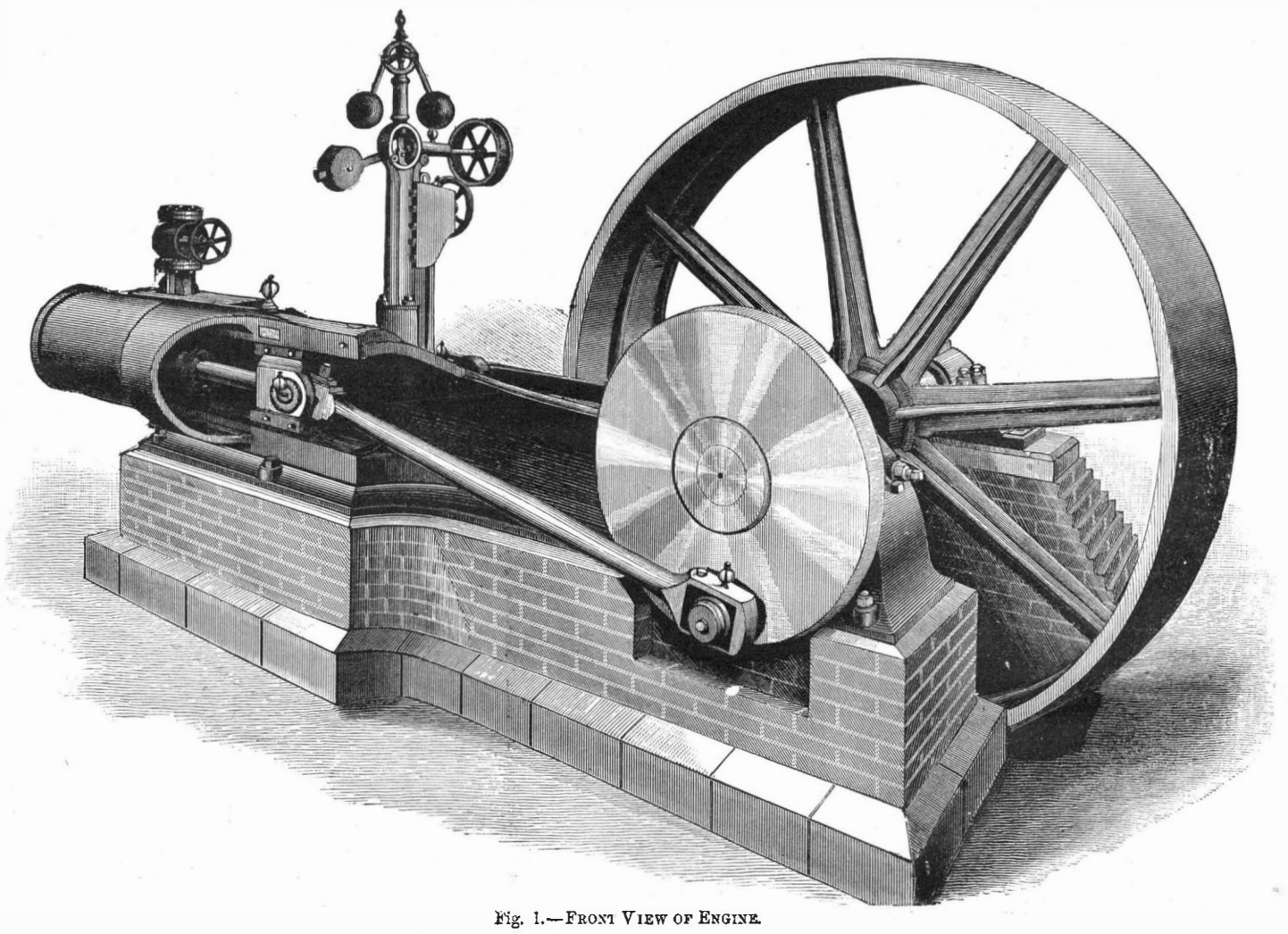
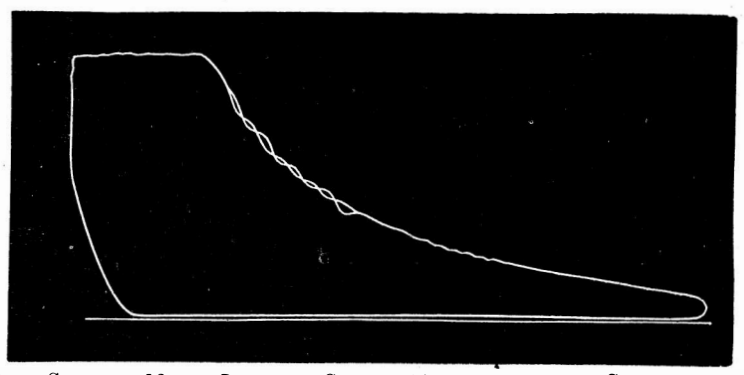


Fig. 1.—FRONT VIEW OF ENGINE.



DIAM. CYLINDER, 12 IN.; LENGTH OF STROKE, 24 IN.; PRESSURE OF STEAM, 55 LBS.; NO. REVOLUTIONS, 110; SPRING, 40.

FIG. 2.

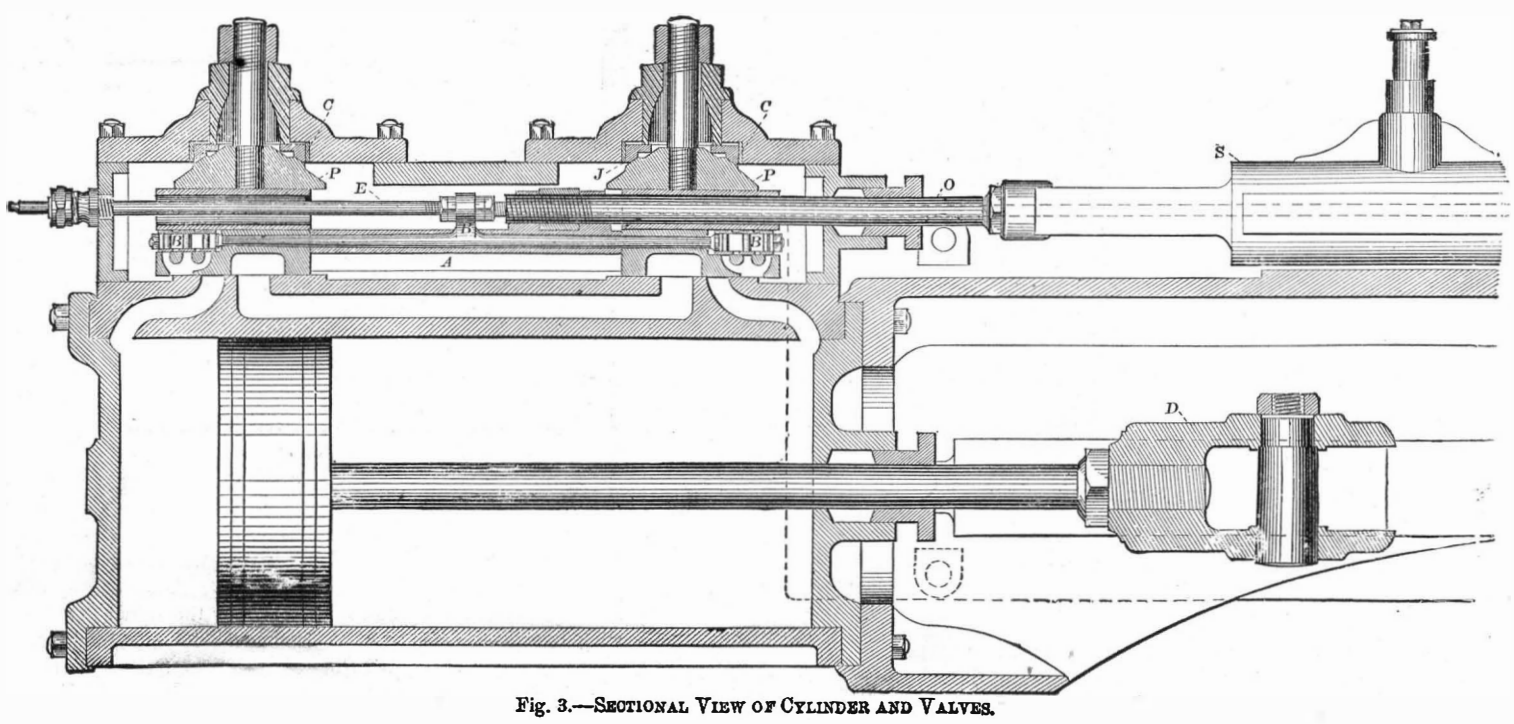


Fig. 3.—SECTIONAL VIEW OF CYLINDER AND VALVES.

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dom from complication. Fewness of parts and the impossibility of derangement are of the utmost importance in the construction of automatic engines, for a saving of fuel is of little advantage, if the amount saved be wholly expended upon repairs or for expensive service to keep the engine running. The engineer capable of running a plain slide valve engine is fully competent to manage one of these

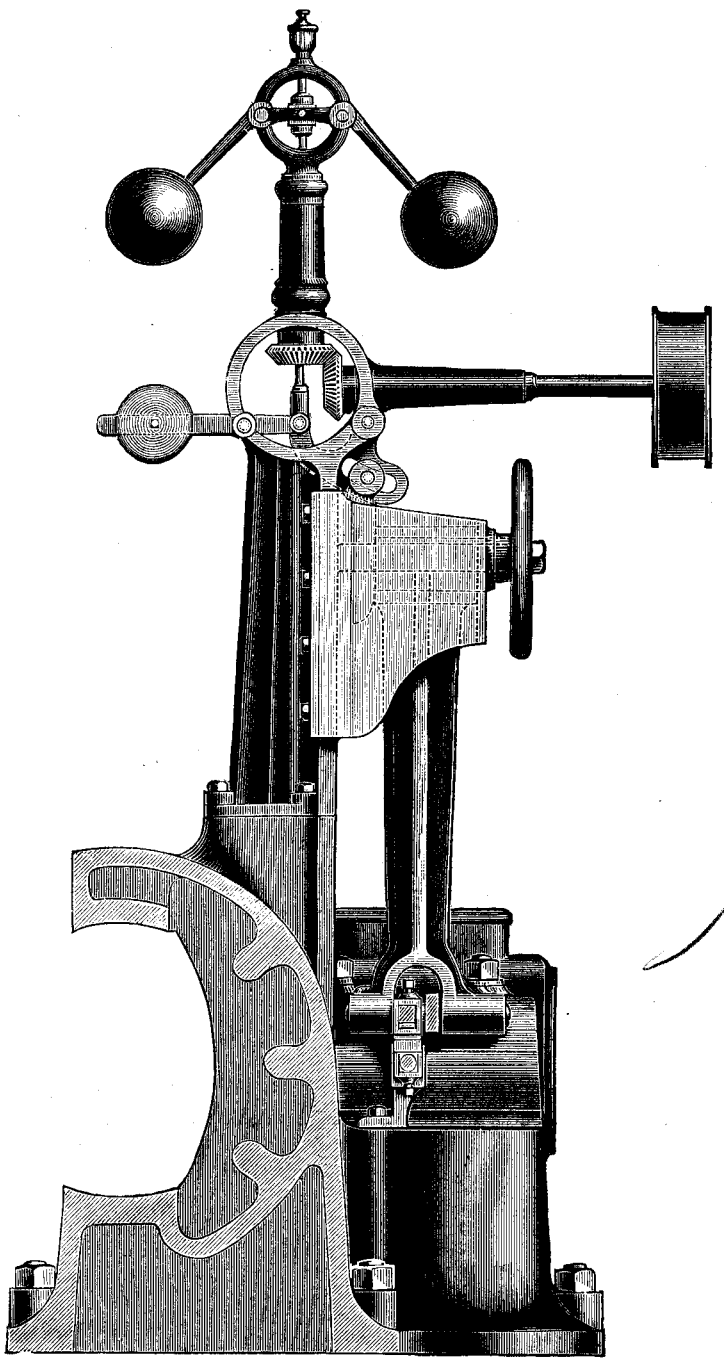

Fig. 4.—VIEW OF GOVERNOR AND SECTION THROUGH BED.

automatic engines, while the cost for repairs should not be in excess of that demanded by the plain slide valve engine.

In addition to the valve gear, we illustrate some noticeable improvements in the details of general construction. The bed has a broad base resting upon the foundation its entire length.

The bed and pillow block are cast in one piece, the distribution of the metal giving it a pleasing and massive appearance, and, at the same time, conveying the strains in the most direct manner possible.

A new feature will be noticed in the construction of the crank shaft box. The side bearings are made very broad, and are slotted to allow the cap bolts to pass through to secure the cap upon the broad surfaces of the side bearings, holding them in their proper position. These bearings are made the length of the diameter of the bore of the cylinder, and are lined with the best Babbitt metal their entire length.

The crosshead is made very long and fitted with wedge-shaped shoes, which rest upon inclined planed surfaces of the crosshead its entire length, and are adjustable by means of screws and bolts, as shown. The shoes have ample wearing surface and are lined with Babbitt metal, so that no appreciable wear should take place upon the slides. These are of cylindrical form.

The connecting rod is made solid at the crank end, the boxes being adjusted with wedge and screws in the usual manner. The boxes are of bell metal lined with Babbitt.

The crank, as will be seen from the cut, is a heavy disk or crank plate, with counterbalance so adjusted with regard to the inertia of the reciprocating parts as to insure smooth running of the engine.

The drop hook is usually made solid, without any provision for taking up the slack or wear upon the pin; and as the hook simply rests upon the upper half of the pin, the wear soon causes an unpleasant jar or knocking. To provide against this, a pair of bell metal boxes are used, the wear of which can be readily taken up without altering the length of the rod or set of the valve, and from which the hook is connected or disconnected without the use of a wrench.

The crank shaft is of best hammered iron. The crank pins, crosshead pins, piston rods, and valve rods are of steel.

The arrangement for balancing the valves of the engine consists of a heavy plate well stiffened to prevent springing, and adjustable by means of a screw and ball and socket joint, by which the perfect seating of the cover to the valve is insured, the adjustment being quickly made with the steam pressure on. This arrangement is both simple and positive.

INDICATOR DIAGRAMS.

As every engineer knows, the actual diagram from an engine, as compared with the standard or ideal diagram, other things being equal, determines the value of any particular valve gear and the economy of the engine. The curve will not in practice conform to the true theoretical or adiabatic curve, the conditions for which are impossible with cylinders made of cast iron. The terminal pressure will always be found relatively too high under the most favorable conditions, the amount being greater as the ratio of expansion increases. Where this is not the case, and the expansion curve of the diagram taken coincides with the adiabatic, the conclusion cannot be otherwise than that the leakage out is greater than the re-evaporation, for as yet we have no practical means for working steam expansively and of preserving the temperature due to the pressure while expanding. This is none the less the ultimate ideal to which less expansion and greater rapidity of working materially contribute. The diagrams here shown are such as are produced regularly by these engines, being facsimiles. They speak for themselves.

A handsome illustrated catalogue of this engine will be sent upon application to A. Welch, Lambertville Iron Works, Lambertville, N. J.

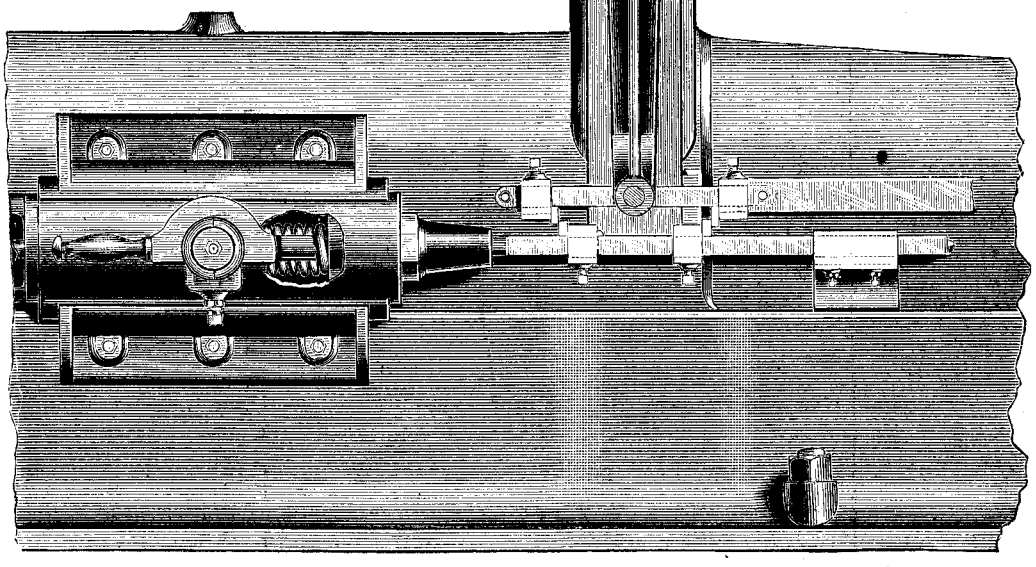

Fig. 5.—GOVERNOR—SIDE VIEW.

Mental Characteristics of Mr. Gladstone and Lord Beaconsfield.

All who have watched the brilliant career of Mr. Gladstone, particularly during the last twenty years, must be conscious of the fact that even his excellent "constitution"—if we may be permitted to use that banned but expressive term—has been often severely tried by the vigor of his brain and nerve power. To the physiologist, who recognizes the interrelation of those parts of the being which some try to separate, and speak of apart, as "mind" and "body," the study of such lives as those of Mr. Gladstone and the late Lord Beaconsfield comparatively with the ideal standard of perfect humanity is intensely interesting.

Lord Beaconsfield had a vigorous but not a thoroughly cultured brain. The development of his cerebral and nervous organism was not, so to say, general, and equal throughout. He had excellent parts and extraordinary intellectual fervor, with a strong will and an immense power of self-restraint; but it is no disparagement of the noble lord's physico-mental organism to chronicle the physiological fact that his brain lacked, and not unfrequently gave unmistakable evidence of lacking, that high coherent development which is only to be obtained by early and persistent mental discipline and culture. He was rather brilliant than grand, as studied from a psychological standpoint, and it was a physiological consequence of his brain type that his policy was one rather of finesse and dazzling energy than of persistent growth of purpose.

Mr. Gladstone, on the other hand, is possessed of a brain which has been physiologically developed by training and exercise commenced in youth and continued far into adult life with an intense struggle for self-improvement by intellectual discipline and industry, and his mind and nerve power are supported by a very considerable amount of sensory and muscular strength and energy. The perils of his life have ever been those of "overwork" in its truest sense. Brain function has frequently outstripped bodily strength; and if his constitution—we again dare to use this word for want of a better—had been a little less strong, if the recuperative power of the organism as a whole had been only a little less considerable, the right honorable gentleman must on several occasions have broken down. The so-called "irritability" of temperament which Mr. Gladstone has, in some of his most trying sessions, been observed to evince, has been the outcome of an over-active rather than a weak nervous system. If it were possible, the right honorable gentleman would even now exhaust his reserve of nerve force by the energy of his great intellect at an age when other men of his caliber have shown symptoms of waning energy.—*Lancet.*

Lack of Encouragement to Inventors.

If inventors were to rely solely upon the commendation of their friends or the public as an inspiration to labor, says an exchange, the source of which is unknown to us, there would be few great inventions. The world looks upon inventors as a visionary and unpractical class of people, who merit only condemnation and ridicule. Just before Singer completed the invention of his now famous sewing machine, even his fellow-workmen in the shop where his experimental machine was being constructed left him in disgust, thinking his invention a failure. When Westinghouse tried to introduce his air brake, he met with the most chilling rebuffs, both in this country and in Europe. Edison, whose inventions are the marvel of the present century, has been the object of unstinted abuse and ridicule. Some of the greatest creations of his wonderful inventive mind were characterized as stupid failures until the demonstration of their successful operation overcame this hostile criticism. Even Thomas and Gilchrist, whose recent invention of the basic process of steel making is among the wonders of modern invention in metallurgical science, have come in for their share of discouraging criticisms and rebuffs. Thus might we go through the whole list of inventors, from the earliest days to the present, and few would be found who have not experienced the unkind and unmerited opposition, not only of the general public, but in most instances of their own personal friends. The testimony of Fulton, Watt, Franklin, and a host of others renowned in the past for their wonderful discoveries would corroborate this statement and furnish forcible evidences of its truthfulness.

Inventors, as a class, are very sensitive to criticism. A part of the reward which they hope to obtain for their invention is a public recognition of its value. None but an inventor can tell how disheartening are the unkind and unsympathetic criticisms which he is forced to listen to; and these criticisms are harder to bear because in most instances they are as unjust as they are unkind, often displaying the ignorance and superficiality of the speaker. That inventors are sometimes unmanned by the ungenerous manner in which their inventions are received is not surprising. A gentleman in one of our Western towns, after years of study, has finally brought forth a very meritorious invention. During all these years he has met the studied opposition of his family and friends. His sons have even carried their opposition so far as to

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refuse to contribute a single dollar toward helping him introduce his invention, now that he has obtained a patent for it, and the result is that, wearied out by the discouragement which his family and friends have placed in his way, he has become prostrated. If, at last, the world shall come to prize his invention for what it is worth, and he shall derive—as he may—a fortune from it, these undutiful sons will, no doubt, be the first to claim a share in the wealth thus obtained.

The man who strives to perfect an invention, whether successful or not, is entitled to the commendation of his fellowmen. We have never sympathized with those who speak sneeringly of that much-despised class of inventors, those who have striven to solve the problem of perpetual motion. Mistaken and erratic as they may be, they are engaged in a line of duty which is, to say the least, honorable and elevating. Thousands of inventions there are to-day that the world calls valueless, which, were they placed in practical hands, would prove most useful and beneficial, and a source of wealth to the owners.

Inventions, as a general thing, are an innovation on present customs or modes, and are therefore a step in advance of present thought. A century since, had any one suggested that one could stand in his own home and hold converse with a frend fifty miles away, he would be thought to be talking nonsense. Had any one at that time said that the mail would be carried from New York to Chicago in a day, he would have been considered equally as foolish. The prediction that messages could be sent on lightning's wing beneath the ocean from this continent to the Eastern continent would have been hailed with ridicule. These inventions were steps far in advance of the thought or knowledge of those days. It does not militate against the greatness of the discoveries that made all these things possible that the dull brain of the masses could not comprehend them until they were practically displayed to the world. The further he is in advance of the present thought or knowledge of the masses, the greater will be the opposition which the inventor will have to overcome before he will attain a just recognition of his labors.

A great inventor must be a man of independent thought, a man of nerve and courage, a man of hopefulness and of determination. Many an inventor has been turned back, even when his feet were pressing the threshold of a great discovery, because he had not courage to stem the tide of opposition which he was encountering. Many a practical invention has been dropped before completion because of the inventor's discouragement and lack of push and determination. Twelve years ago a certain inventor filed in the Patent Office at Washington an application for a patent for the invention of a certain article. On some technical grounds the patent was disallowed. The inventor, in the meantime, had been discouraged by his friends, and so ceased pressing his claims. What, then, must be his surprise to find his invention now in quite general use, years after he had surrendered it to the public. The experience of this man is but a sample of the experience of thousands of others.

It is a surprising thought, when contemplating what invention has done for the progress and civilization of the age, that inventors meet with such a tardy recognition of their works. The wonder is that they are not held in higher esteem. The world could afford to pension its Stephensons, its Morses, its Bessemers, its Edisons, and its Bells. It has erected statues to some of these, and it can afford to erect statues to all its noted discoverers. In olden times men of scientific attainments were held in high esteem. Why ought they not to be held in a like high estimation to-day?

We grant that the names we have given above are so held, but there are untold thousands of names of inventors of useful things, valuable and indispensable to the world, that should be placed in glowing letters on the scroll of fame. Our inventors need encouragement when they are alive, not after they are dead. Men do not work simply to gain a fitting epitaph. Their needs are in the present, and the earlier the world recognizes and applauds their work, the better will it be for them and the inventive art.

The Loss of the City of Brussels.

The sinking of an Inman steamer at the mouth of the Mersey appears, at first sight, to be an almost incredible event. Liverpool passenger steamers have come to be regarded as at least as safe means of transport as railway trains; and it is not too much to say that a railway journey of 3,000 miles performed in any country would be attended by as much risk as a voyage across the Atlantic in one of the ships of this celebrated fleet. The precautions taken to insure the safety of passengers by the Cunard and other companies leave absolutely nothing to be desired. The Cunard steamers, for example, are now, and have for some time back, ceased to be either the largest or fastest crossing the Atlantic; but as regards safety they enjoy an unrivaled reputation.

The announcement that the City of Brussels had been sunk, and that several lives had been lost close to Liverpool, was at first received with doubt. It remains of course to be proved that the officers of the ship are in no way to blame for the catastrophe. With the details of the collision, which sent a fine steamer to the bottom, our readers are, no doubt, familiar; but it may be worth while to place the fact on record in our pages for future reference. On Sunday morning there was a thick fog in the Mersey, which extended some way out to sea. The Inman steamer City of Brussels had made a very satisfactory passage from New York to Queenstown, and a good run from Queenstown to the mouth of the Mersey. Then the fog settled down, and no further progress without extreme risk became possible; so Captain Land, who was in command of the ship, as soon as he heard the sound of the fog bells of the North-West Lightship, turned the ship's head to sea, stopped her engines, and allowed her to drift up stern first toward the bar. It is stated that he kept his whistles going at half minute intervals. Forty-one minutes after the engines had been stopped the sound of another steamer's whistle was heard, and immediately afterward the City of Brussels was struck on the starboard nearly amidship by the Kirby Hall, a new steamer on her trial trip from Glasgow. The Kirby Hall, a ship of about 1,500 tons, cut well into the City of Brussels, making a hole, it is said, 8 feet wide, and below the water line. The Kirby Hall had her own bows twisted, but it does not appear that she suffered any serious injury. She has a large rent in her plates from the 18 foot watermark to the 24 foot. She was flying light, and to this fact she probably owes her safety, as she made, we understand, little or no water, all her injuries being above the sea. Captain Land and his officers did all that men could do, and succeeded in saving the lives of nearly all on board. The discipline of the ship was perfect, the boats all ready for launching, and the result was, on the whole, satisfactory. Several lives, however, were lost, eight of the crew and two passengers, Italians, being drowned. So much for some of the facts concerning the catastrophe. Let us see what is the lesson it conveys; for there is no such thing as an accident. Nothing happens without a cause, and if we rightly understand what caused a given "accident," it is possible that we may be able to avoid its recurrence.

The first point worth notice is that the case of the ship, after she began to leak, was hopeless. Nothing could be done to keep her afloat. But, nevertheless, unaided as she was by any assistance from her crew, she did not founder for about twenty minutes. Now, even the sinking of ships is effected according to rule and law by nature. Not one pound of water less than a certain quantity would have sunk the City of Brussels, and the rate at which this water got into her was fixed by immutable rule. The City of Brussels was 390 feet long, and 40 feet 3 inches beam. Her gross tonnage was 3,774; her net tonnage, 2,434. Her bunkers must have been nearly empty, and would represent a space capable of holding, say, 800 tons of water. She had a valuable cargo on board, but not, we fancy, a heavy one. If we say that her margin of floatation was equivalent to 1,800 tons or so, we shall not, we think, be far short of the mark. To sink her she must therefore have taken 1,800 tons of water on board. It is quite certain that some obstacle intervened to prevent the water from finding its way through the whole ship at once, because, if a hole 8 feet wide had been knocked in her side, assuming it to be only 4 feet deep below the surface, she would have taken in enough water to sink her in less that five minutes, the head rapidly augmenting as her bows sank.

The ship was, however, divided by watertight compartments, and probably a single compartment was rapidly filled, and this having been done, her head was so far pulled down that water found its way over the deck to which the bulkhead extended, and thence ran aft. The ship, however, went down by the head; and it is noteworthy that she remained afloat until the water reached the bridge. The City of Brussels had nine bulkheads and seven watertight compartments; and it is said that the reason why she foundered was that the Kirby Hall struck her just at the end of a bulkhead, and so knocked two compartments into one. This is, however, to a large extent, pure conjecture; and even if it is true, then the circumstance supplies another argument in favor of so constructing bulkheads that two compartments cannot be knocked into one. How this is to be done we explained fully in the *Engineer* for June 14, 1878, page 416.

Be this as it may, it is clear that if the bulkhead had been more efficient, the City of Brussels might now be lying in dock in Liverpool. But assuming that the bulkhead was what it was—inefficient beyond a certain point—it is easy to see that, had very moderate pumping power been brought into play, the ship could have been kept afloat. The utmost quantity to be dealt with was, say, 2,000 tons, to be lifted, say, 20 feet in twenty minutes. This represents but 40,000 foot tons, or 4,480,000 foot pounds per minute, or 135 horse power; or, making large allowances for waste, an engine of 250 indicated horse power, properly used, would have kept the water pumped out of her as fast as it came in. She had an ample supply of steam available, and one large centrifugal pump would, in all probability, have sufficed to save her. Assistance was close at hand, and even with one compartment full she might have been towed to a place of safety, her own pumps dealing with what we may term the overflow over or past the bulkhead. The ship and her cargo have been valued at £300,000. We speak close to the truth if we say that a pump and engine of the required power could have been had for £1,000.

We are happy to know that in most of the great passenger steamers recently built immense pumping power has been provided; but the City of Brussels was thirteen years old, and sufficient importance was not then attached to pumps; and here we may hint that the various Liverpool companies running passenger steamers across the Atlantic would find it immensely to their advantage if they could state in their advertisements that their ships were fitted with appliances which would deal with huge leaks. The passenger public at both sides of the Atlantic is very discriminating, and it would not be slow to understand which was the safest ship.

Two other questions remain for consideration. Was the City of Brussels provided with any special sound signaling apparatus which would denote which way her head lay, and whether she was or was not in motion? We believe she was not; that, in short, she had nothing but the ordinary steam whistle. Is it not time that a universal code should be adopted, which would be intelligible to all ships, and which would tell an advancing steamer that, "I am here, lying with my head to the west, drifting astern," or "I am going dead slow with my head to the south." There is no want of such sound signals in the market. Another question is, When will ship owners or the Board of Trade, or "Lloyd's," or the Liverpool underwriters, take the bulkhead problem in hand? It is a noteworthy fact that this is a subject on which the Institution of Naval Architects never touches. Those who read papers and those who discuss them alike seem to regard the matter as tabooed. If it is referred to at all, it is so only in connection with ships of war. We know that among ship builders there is a rooted contempt for bulkheads, and this is not to be wondered at, seeing that they themselves have done their utmost to make them contemptible. As they are usually fitted, they cost some money—not much, it is true—they are a nuisance to the owners, coming as they do more or less in the way of cargo, and they are absolutely worthless. We shall feel indebted to any one of our numerous readers who can give us particulars of a single case in which bulkheads prevented a ship from foundering. We do not now refer to collision bulkheads, which are almost invariably well made, well designed, and therefore quite efficient. We refer to the other bulkheads, which, if as good, would be as useful.

By only too many persons it is assumed that the modern passenger steamer is as safe as she can be made. The foundering of the City of Brussels is proof that she is not safe, and there is a universal consensus of opinion among engineers, at all events, that passenger steamers can be made much safer than they are. If the time of foundering in case of collision could always be delayed by some few hours, an immense advantage would be gained; and it really appears that if those most concerned would do what can be done to secure this end, a great deal might be effected. It requires, we hold, but a moderate effort on the part of Lloyd's and the Board of Trade, and the thing could be done. Unless they act, bulkheads will probably continue to be delusions and snares to the end of time.—*The Engineer.*

The Steam Engine and the Telegraph.

Mr. Courtney, in presiding at the annual meeting of the Royal Cornwall Geological Society at Penzance recently, referred to the introduction of the electric telegraph and the invention of the steam engine, by which electricity and steam had been made our slaves in almost all the operations of life. No doubt, these were most remarkable applications, and we in the present day were greatly indebted to them, but at the same time he was bound to say that in his opinion we might overrate the debt. The conveyance of news by the telegraph was insignificant if the news itself were not of importance. As to the diminution of toil which steam effected in supplying our wants, it depended very much on the use we made of it, and how far that did or did not confer a benefit on mankind. Was it a fact that owing to the introduction of steam the labor which was necessary for the subsistence of the multitude had been in any sense diminished, and the ragged edge of pauperism which surrounded the borders of society had in any sense disappeared? We might derive either of two advantages from the introduction of steam—we might either make life less toilsome while maintaining the mass of it as it was, or keep up the toil of life while increasing the mass, and he was afraid the result of the discovery of steam power had been an increase in the number of human beings rather than an improvement in the quality of life. He was, indeed, more disposed to reverence science for its educational than for what he might call its economic advantages, for the way in which it elevated the mind of man rather than for its ability to enable more men to live on the same low level on which men lived before, and it was because he believed in geology, and its kindred science, astronomy, as most powerful helps to the elevation of the mind of man that he was willing to pay his humble respects to those who prosecuted those particular sciences and conveyed to others their blessings.

Absorption of Hydrogen.

A. TSCHIKIKOW.

It has been shown by W. Hempel that hydrogen is completely absorbed by palladium sponge at 100°, and he has used this as a means of separating hydrogen from a mixture of gases. In order to test the applicability of this property to the estimation of hydrogen evolved in sealed tubes, the author treated zinc with hydrochloric acid in a sealed glass tube containing a palladium spiral. The proportions of acid and zinc were such as to produce a pressure of twenty-five atmospheres if no hydrogen were absorbed by the palladium. The absorption was found to be complete. A small portion of the hydrogen had united with the oxygen of the air remaining in the tube. Nearly the calculated amount of hydrogen was obtained from the palladium spiral by heating to 350°. The evolution of the gas was so regular that the author suggests the heating of palladium-hydrogen as a means of obtaining chemically pure hydrogen.—*Amer. Chem. Jour.*

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Correspondence.

Size of Chimneys.

To the Editor of the Scientific American:

On page 396 of SCIENTIFIC AMERICAN, vol. xlvii., query 8, H. N. asks for the proper size of a smoke stack. The boiler is 3½ feet in diameter and has forty 2¼ inch tubes nine feet long.

The query and your reply open quite a little field for profitable investigation. Your reply is, "At least 20 inches diameter," and yet your reply is based upon no rule. "There is no rule." Allow me to inquire if experience has fixed the size of the smoke pipe at that particular figure for a boiler of that description? It seems to me there ought to be a rule, and that such rule should be founded in reason. Experience teaches a dear school, and it has been my lot to learn or to invent a rule from this school of experience at a cost of some thousands of dollars. Why should the smoke pipe be twenty inches in diameter? The area of the forty tubes is 159 square inches. Is there any reason why your draught should "be cramped in the tube"? "Cramping" your draught destroys it. The sum of the areas of the tubes is 159 square inches. A smoke pipe 20 inches in diameter contains 314 square inches. Why have more room in the smoke pipe than in the tubes? The gases in passing through the tubes become cooled, and consequently reduced in volume. If you now put them into a pipe of twice the capacity, you largely increase the radiating surface, and hence the heat of the gases in the pipe are more rapidly cooled than they would be in a smaller chimney. The difference between the weight of a column of the gases inside the chimney and of a similar column of air outside is the cause of *any* draught. Hence the theory that the flue may be gradually decreased in size as the temperature of the gases decreases from the fire box to the top of the chimney, thereby giving a uniform motion to these gases through the boiler and smoke stack. Again: The more heat you can get into your chimney, the the stronger will be your draught. The less radiation *in* the chimney, the better the draught. For this reason a good brick chimney is better than any iron chimney.

I have a rule which it was necessary for me to devise, and which is based upon the principles of reason which I have here given. The air space through the grate bars should be only one half the area of the tubes, and I make the chimney the same area as the sum of the areas of all the tubes, and make no wider or larger spaces in the flue after passing the tubes than the sum of the areas of the tubes. Let the fire box be no larger than is necessary to build such a fire as may be supplied with air with strong velocity through the grate bars, and whose gases can pass through the tubes without being "cramped" without too rapid motion.

Tubes may be so long as to destroy any possible draught. My recollection is that nine feet is pretty long for a 2¼ inch tube. They should never be longer than is necessary to take such amount of heat from the gases only that the remaining heat in the chimney will produce the desired amount of draught.

HENRY BAXTER.

[We agree with you in your reasoning about chimneys. There are plenty of rules for smoke chimneys, but no two agree. The size of the chimney was given for supposed consumption of fuel on the grate, and with no reference to the tubes. If the builder chose to put in four tubes instead of forty it would not alter the proper size of chimney for the grate.—ED.]

An Appreciative Reader.

To the Editor of the Scientific American:

I have taken the SCIENTIFIC AMERICAN for ten years and the SUPPLEMENT from No. 1 up to the present. I have all my papers from the time stated, neatly bound and put up in a case, with the number of volume on the back of each. And I would not take one hundred dollars for them, as they are of unlimited value to me, and have proved so hundreds of times. I believe if it were more generally known how much one year's numbers of the SCIENTIFIC AMERICAN contain of real valuable matter to the mechanic few would be without it. I am not a man of wealth, but if your paper cost $10 a year I could not afford to be without it, and would not.

W. S. HARRIS.

Croton Falls, N. Y.

How to Lacquer Brass.

To the Editor of the Scientific American:

I notice in your issue of December 30, 1882, page 424, No. 6, Notes and Queries, that J. A. is in trouble with some lacquering, and being in that line of work myself, think some suggestion by me may help him.

LACQUERING BRASS.

1. Be sure there is no oil or grease on the brass; do *not* touch the work with the fingers, hold it with spring tongs or a taper stick in some of the holes.

2. *Always* handle with a piece of clean cloth.

3. Heat the work so hot that the brush will smoke when applied, but avoid overheating, as it burns the lacquer.

4. It is well to fasten a small wire across the lacquer cup, from side to side, to scrape any superfluous lacquer. The brush should have the ends of the hairs all exactly even. If not so, trim the ends with sharp scissors.

5. Scrape the brush as dry as possible on the wire, making a flat smooth point at the same time.

6. Use the very tip of the brush to lacquer with, and carry a steady hand.

7. Put on at least two coats. It is well (to make a very durable coat) to "blaze off" after each coat, with a spirit lamp or Bunsen burner, taking care not to overheat and burn the lacquer.

8. If the lacquer is too thick, it will look gummy on the work. If too thin, it will show prismatic colors. In the first case, add a little alcohol; in the latter, set the cup on the stove and evaporate some.

9. A good deal of cheap work, like lamp burners, is "dipped." Use a bath of nitric and sulphuric acids, equal parts, dip work, hung on wire, into acid for a moment, remove, rinse in cold water thoroughly, dip in hot water, remove, put in alcohol, rinse around, then dip momentarily in lacquer, shaking vigorously on removing to throw off extra lacquer and lay on a warm metal plate till dry, let cool, and it is done.

10. Avoid handling lacquered work until *cold*.

Q. Y. X.

Newton Center, 1883.

Protection of Theaters against Fire.

The following is an abstract of an address by Edward Atkinson before the Boston Police Commissioners:

I am not familiar enough with the condition of theaters, behind the curtain, to be able to say that the use of automatic sprinklers above and around the stage should be made compulsory upon your part. I am informed that theatrical managers think the use of this system impracticable, even if desirable, and it is for that reason only that I qualify the opinion submitted. It is a question of fact very easily determined. This much I do say, if there are no special reasons against the use of automatics as an additional safeguard against danger from fire, although not as a substitute for any other appliances, no well-managed theater can afford to be without them. I would advise every theatrical manager, and every person interested in saving either property or life in theaters, to visit Providence and attempt to burn the combustible building which has been set up by the Providence Steam and Gas Pipe Company for purposes of experiment.

Let me state to you the course which I have taken with many men insured in the factory mutual company of which I have charge, who have been as skeptical in regard to the automatic sprinkler as, I believe, theatrical managers are at this time. When I advise them to protect their premises with these additional appliances, after having required pumps, hydrants, hose, pails, and buckets, and have then advised more buckets and pails, and after a sufficient supply of buckets, more pails, and then more buckets, all to be kept constantly full of water—and when I find them still doubtful as to the expediency of spending more money for self-protection, I give them this advice: "Go to Providence, and burn Mr. Grinnell's building if you can;" and this is what usually happens: The experimenter builds a fire upon the wooden floor of this combustible wooden building, of such a sort that he feels absolutely certain he will burn the building; he then sets it on fire, and steps to the door, remarking, "That building is gone up, dead sure." He waits thirty seconds, and then turns round to Mr. Grinnell with this further remark: "I am ready to sign a contract for the protection of every part of my premises with your sprinkler, whether Atkinson says so or not." The interruption in the course of his thought, by the extinction of the fire in that half minute, has sufficed to convince him that the automatic will put the fire out. If these gentlemen representing Boston theaters will go with you to Providence, and try this experiment, I think you will have no occasion to pass a compulsory ordinance.

Since you asked me to appear before you, I have requested leave to go upon the stage of the Boston Museum, and after examining their appliances for extinguishing fire at the first instant of its appearance, by the use of their system of perforated pipe sprinklers, together with their rules whereby the turn of the valve at the right instant, in case of fire, is as well assured as any act can be by human prevision and action, I concluded that such care and good judgment had already been taken by the managers of that theater for the protection of life, utterly irrespective of any question of property, that I concluded it might be unreasonable to compel the managers of that theater to add the automatic system to what they now have, against their own judgment. They have been moved by influences, deeper than any city ordinance, to do what they believe to be necessary and adequate. It would certainly be unfit to compel them to substitute automatic sprinkling for their present system of perforated pipes worked by means of valves; but I believe Mr. Field will himself decide to add the automatic system as quickly as a proper plan can be adapted to the conditions of a theater, so soon as he has tried the experiment in Providence, which I recommend to him and others.

In view of the fact that there may be some conditions in theaters so different from those of factories as to make it difficult to adjust the automatic system; I am only perpared to advise to this extent, that you should require the use of an adequate system of sprinkling, either the perforated pipe adjusted like those in the Boston Museum, or the automatic system, if it proves to be feasible, in every theater licensed in this city; and I think you will not completely fulfill the duty which you owe to the citizens if you fall short of the enactment of such an ordinance.

May I now be permitted to suggest an additional ordinance for the adoption of automatic sprinklers in some other premises. Referring to the late fire in Lovell's gun shop upon Washington Street, where the fireman were perhaps exposed to greater danger from the explosion of the cartridges than they were from the danger of the gunpowder kept in stock, I beg to suggest that gunpowder and cartridges might well be kept in stock in a chest, built of light pine wood incased in tin, and placed where it could be readily removed in case of need. A small chest would suffice for the gunpowder alone. Connected with this chest there should be a city water pipe, fitted with an automatic valve on the outside, which would be released by the heat of a fire in any part of the shop, whereby the chest would be filled with water, and after being thus filled, the continued flow of water would be over the outside. The place for such a magazine should be close to a door or window and under a brick arch, sufficiently strong to resist the falling of timbers or walls upon it, so that the chest might not be broken if circumstances prevented its removal before the complete destruction of the building, Such a chest, made of pine wood protected with tin, would be light and strong, and very much safer than iron. Iron is one of the most treacherous of all substances under fire, and the building act ought to prohibit such use of cast iron girders as is now not uncommon. I should also think it would be expedient to require automatic sprinklers in all shops or premises in which fireworks are made or kept in stock for sale.

The work which has been done by automatic sprinklers in saving mill property from loss, where fires have actually occurred under the most dangerous conditions, has caused the mutual underwriters to press for their adoption throughout the premises insured by them, which had not been previously protected in full by the old fashioned perforated pipe sprinklers. We do not think it reasonable to compel our members to change or substitute the automatics for perforated pipe, but some of them, perhaps the most judicious of the number, are doing this without being asked by us in the more hazardous part of their works. Had the mill lately destroyed by fire in Fall River, been protected by self-operating automatic sprinklers, it probably would have been saved; it was not saved by the perforated pipe sprinklers, because the valves were not judiciously worked at the right time.

Carbamide as a Substitute for Quinine.

The *Journal d'Hygiene* learns from Gen. Kokhowski that Dr. Belvousoff has discovered an efficient successor for quinine. Belvousoff, Prosector at the University of Kharkoff, presented his memoir before the Russian Commission of hygiene on the 5th of October last, recommending carbamide, the rational formula of which is

$$\left.\begin{matrix}CO\\H_2\\H_2\end{matrix}\right\}N_2,$$

as the substitute for quinine.

From experiments made in the hospitals, the following results were obtained: 1. That in cases of intermittent fever carbamide acts as a specific. 2. That this remedy can be employed in many other complaints to reduce the temperature of the patient; it is, moreover, without taste, and does not depress the nervous system.

This action of carbamide is easily understood in the light of the latest researches on uremia. It is also well known that in southern Russia and Montenegro the peasantry are accustomed to cure themselves of intermittent fevers by the use of urine as a medicine.

Belvousoff has also shown that carbamide instantly kills the lower organisms, such as bacteria and vibriones, just as quinine does.

From an economical point of view, says the writer, the discovery is very important, as carbamide is much cheaper than quinine.

[Carbamide, or *urea*, can be obtained from urine, but is usually made by the action of cyanate of potash on sulphate of ammonia.]

Railroad Law.—Railroad Track in a Street.

The owner of lots on a street in Denver, upon which he had erected a hotel and dwelling house, sued the Union Pacific Railroad Company to recover damages for the injury to his property by the laying of its track in the street. This track was put down 18½ feet from the pavement and above the level of the street, so that wagons could not freely pass to and from the houses. The company set up as its defence that the track had been laid by virtue of an ordinance which granted it the right of way through the street. The plaintiff recovered a judgment for $1,850 in this case—Malandin *vs.* Union Pacific Railroad Company—in the United States Circuit Court for Colorado. Judge Hallett, in the opinion, said: "The right and interest of the plaintiff in the street in front of his property is secured to him by section 75 of the Bill of Rights of the State constitution, which declares 'that private property shall not be taken or damaged for public or private use without just compensation.' It has been said that property cannot be 'taken' within the meaning of that provision except by an appropriation of the land itself, but no such limitation is applicable to the clause relating to damages. The beneficial use of plaintiff's estate embraces the right of ingress and egress, which cannot be withdrawn or obstructed without substantial damage to it. The use of the street is therefore a right of property in plaintiff, which, if not 'taken,' is certainly 'damaged,' within the meaning of the constitution, by the act of defendant in building its road through the street."—*Baltimore Day.*

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IMPROVED BAND SAW.

Until within a few years, the manufacture of band and scroll sawing machines was carried on as a side matter, or a "filling in," by large concerns making every variety of wood cutting machines. In consequence of this no particular attention was paid to improving and simplifying designs or systematizing their manufacture. Orders were taken for them to complete an outfit, and they were made a few at a time, according to the number of orders on the book. Goods made this way cost a great deal more money, proportionately, than a regular line of work, and the purchaser had to stand it.

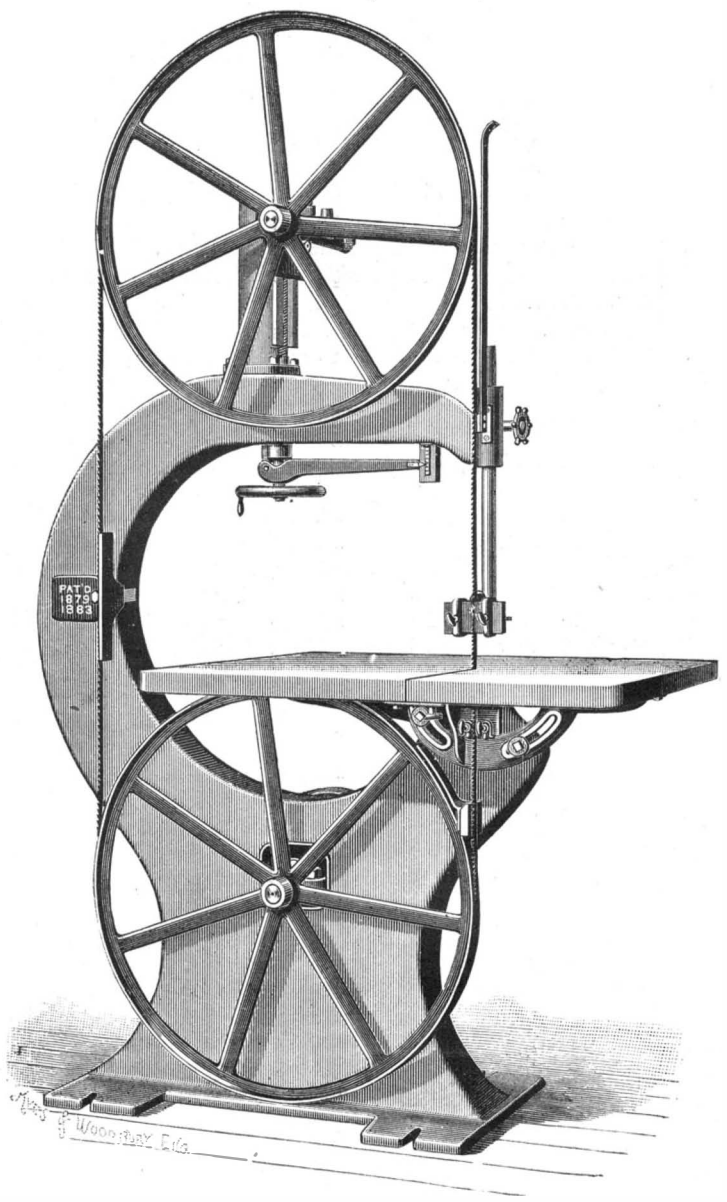
The machine shown in the engraving has been made a specialty, and modern conveniences are applied in the manufacture by which they are fitted up. Costly special tools have been constructed, competent workmen are employed, and in this way a good article is produced at a much lower price than by the old method.

By recent improvements this well-known tool has been rendered very efficient and durable. A new blade straining device has been introduced, whereby a balance lever is made to show on an index plate the amount of tension necessary for any size of blade. The index plate is immediately in front of the operator, and there is always an elastic strain on the blade, no matter what its size, thus avoiding a serious difficulty in counter-weighted machines, by which light blades are strained rigidly when the weigh is set for a wide blade and carelessly left there by the operator, as often happens.

The wheels are iron, and have improved concave arms and T rim, by which they are made light and strong, and they are covered with canvas-strengthened pure rubber bands, securely cemented, and ground perfectly true. The shafts are of steel; the lower one has bearings 6 inches long, the upper one having a single bearing 12 inches long. The latter is adjustable, so as to shift the blade on the wheels. The loose pulley is self-oiling, and its hub is 7 inches long. The frame is hollow and cast in one piece, according to the best modern practice, and is finely designed and proportioned for strength. The machine is provided with steel self-oiling guides both above and below the table, having all necessary adjustments, and so arranged that wood may be used for side guides if preferred.

This machine is adapted to general work of all kinds, such as is found in agricultural, cabinet, car, chair, carpenter, millwright, pattern, wagon, and job shops, in both hard and soft wood. It can be arranged for resawing or splitting lumber up to 10 or 12 inches wide successfully.

This machine is manufactured by Mr. F. H. Clement, 123 Mill St, Rochester, N. Y.



CLEMENT'S BAND SAW.

One Blast of 130,000 Tons of Rock.

A notable blast was discharged January 11 at the limestone quarry of the Glendon Iron Company, Easton, Pa., displacing, it was estimated, 130,000 tons of rock. The blast was made in a hill 150 feet high and very steep. Three tunnels, about 100 feet apart, were run into the hill northward, and two smaller tunnels ran to the east and west. In the six chambers at the ends of the tunnels were placed 29,000 pounds of Judson powder, having, it was estimated, the rending force of 36,500 pounds of common powder. The blast was fired by electricity. It was the heaviest ever made in that part of the country, and one of the heaviest recorded.

IMPROVED COTTON CHOPPER.

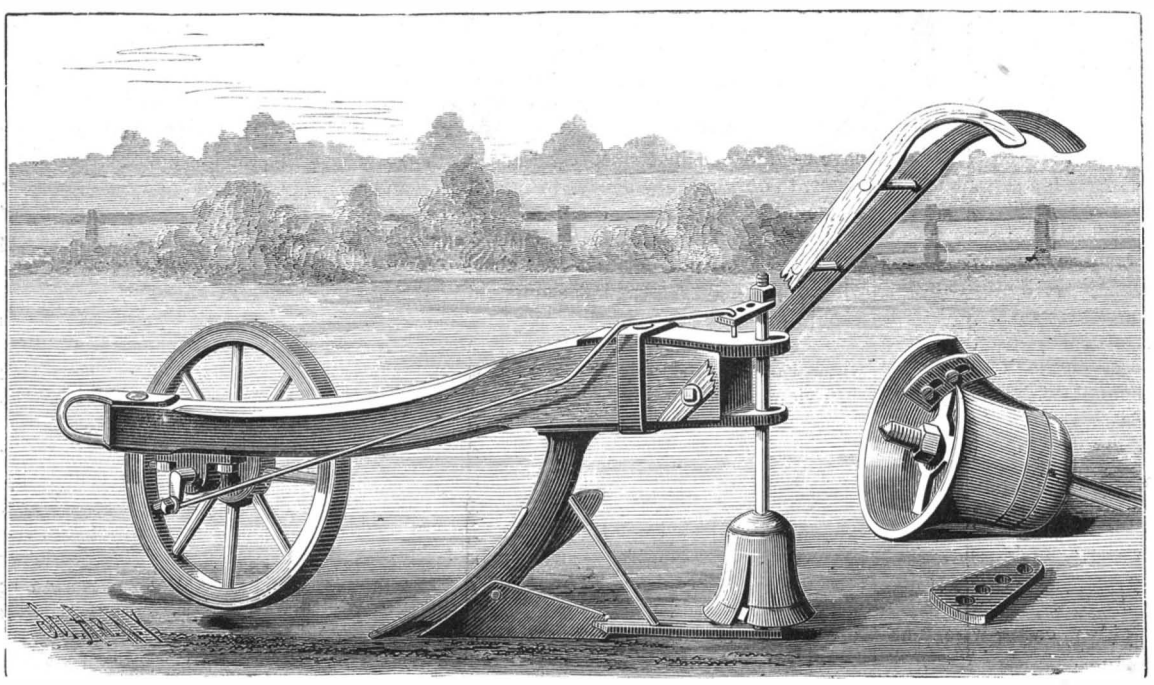
The engraving represents an improved cotton chopper, consisting principally of a slotted bell-shaped cutter, adapted to be attached to any plow, and to receive rotary reciprocating motion from a drive wheel attached to the plow beam. The cutter has an adjustable knife for closing the slot in the cutter more or less, so that the slot will leave a greater or less number of plants in the stand.

The plow to which the chopper is attached may be of any approved construction. The cutter is, by preference, made bell-shaped, and is formed with a vertical slot, and provided with an adjustable knife, placed inside of the cutter. The cutter is attached to the plow by means of the bearings at the rear end of the plow beam, in which the upper end of the shaft of the cutter is journaled. The lower end of the shaft is journaled in an arm extending back from the land side of the plow.

The chopper receives a reciprocating rotary motion from the crank shaft of a wheel journaled near the forward end of the plow beam. The shaft of the cutter is held in line with the land side of the plow, so that one-half of the diameter of the cutter will reach outside of the plow to the left, and will reach over the row of plants being chopped out.

In use, the rows or drills of cotton are first furrowed off along one side by the plow, or a plow without the cutter attached. The cutter is then attached to the plow, and the plow is run along the other or unfurrowed side of the rows. The cutter, reaching over the row, will cut out all of the plants in the row until the slot is brought, by the rotary reciprocating movement which the cutter receives from the drive wheel, in line with the row of plants. When in this position the cutter will skip the plants in the row until it is turned back so that the slot is no longer in line with the row, when the cutter will again cut all of the plants in the row. The cutter, having a regular rotary reciprocating motion, the plants will be skipped regularly, making hills at uniform intervals along the row provided with standing plants opposite the slot in the cutter.

The distance between the hills may be increased or diminished, as desired, by changing the connecting rod in a series of holes made in the crank. This invention has been patented by Mr. Martin S. Michaelis, of Benton, La.



MICHAELIS' COTTON CHOPPER.

The Pioneers of American Railroading.

Mr. John Raymond, of Scranton, Pa, died in that city, December 22, 1882, at the advanced age of eighty-seven years.

Mr. Raymond built the first mile of railroad in America for the commercial use of steam locomotives. The track was on the Delaware and Hudson Canal Company's road, between Honesdale and Carbondale, Pa. The first locomotive used was the "Stourbridge Lion," built in England. The engineer was Horatio Allen, now living at East Orange, at the advanced age of nearly ninety years.

The first run of the locomotive on the Honesdale road was made August 28, 1829; but this was not the first trial of the engine in this country. The engine was put together at the West Point Foundry, foot of Beach Street in this city, and was there tested August 8, 1829, on a trial track about 2½ miles in length. This run was also made with Mr. Allen as engineer.

Mining Experts.

A writer in the *Mining Review* concludes that no class of men have been so poorly appreciated by both miners and investors in mining property as the mining expert, but he predicts that the day is at hand when conscientious men, who have carefully studied the sciences of geology and mineralogy, and by practical and extended experience become familiar with rocks and minerals, will be in active demand to determine the investment of capital in new mining districts.

The best business men at the present time, and most successful in their mining investments, keep in their employ a trusted man, and all purchases of mining property are made upon his favorable report.

The extent of mineral bearing fields and the great variety of formations and ores make it impossible for the "tender-foot" or even the experienced miner to master the geological and mineralogical laws as one who has spent a life-time in the broad and thorough investigation of these things, with every available appliance of the past and present; and thoroughly qualified men will now be recognized as they never have been before.

In every other science we avail ourselves of the knowledge and experience of those who have made themselves familiar with its highest development, and recognize the worth of men of ability and high achievement. Mining is rapidly rising up out of the domain of chance and speculation, and is taking its true position as a business, based upon a substantial foundation, and governed by laws of a science as deep and grand as any which the wisest philosophers have ever investigated, reaching back to the beginning when the earth was void and without form, and its elements were tossing in the tumult of chaos. The opening of a new season will make a demand for thoroughly well qualified and reliable men; let such men be prepared, not only to faithfully perform their duty, but to vindicate the honor and value of their profession.

Effects of Diet on Liability to Infection.

Professor Feser, of Munich, has been making experiments on animals with a view to establishing the connection which exists between diet and liability to infection. In the trials he has made on rats inoculated with the poison of cattle distemper, he demonstrated the fact, says the *Lancet*, that the animals which had been fed on vegetable diet were quickly attacked by the disease, while those which had been fed exclusively on meat resisted the effects of the inoculation. In recording this fact, a leading journal, in connection with the Continental leather trade, attributes to the greater amount of vegetable diet, in the shape of bread, beer, etc., taken by woolsorters between Saturday and Monday, the greater frequency of cases of outbreak and the aggravation of disease during that period.

KRUPP'S works, at Essen, now employ some 439 steam boilers; 456 steam engines, with an aggregate horse power of 18,500; 89 steam hammers, varying in weight from 200 pounds to 50 tons; 21 rolling mills; machines for making tools, 1,622; furnaces, 1,556, of which 14 are high furnaces; 25 locomotives; and 5 propellers, with a tonnage of about 8,000. Annual production, 300,000 tons steel and 26,000 tons iron.

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APPARATUS FOR REMOVING GREASE, AIR, AND IMPURITIES FROM FEED WATER.

The first practical application of the apparatus shown in the engraving was on the steamship Walla Walla, on a voyage from New York to Portland, Or., and while it operated extremely well during that experiment, it has since been improved so as to make it almost automatic.

It removes the air usually forced into the boiler with the feed water, thus, it is claimed, removing the cause of pitting the internal surfaces of boilers and tubes by removing the free oxygen from the water. The removal of the air also prevents priming, and in condensing engines it effects a great saving by excluding the air from the boiler and cylinder, thus preserving the vacuum; and in addition to these advantages, it insures even feeding in a battery of boilers, and in all cases the apparatus indicates whether the pumps are in action by the continual working of the air relief.

This apparatus extracts all grease and foreign matter which would otherwise enter the boiler and be deposited as scale, or would form a surface scum which needs continual blowing.

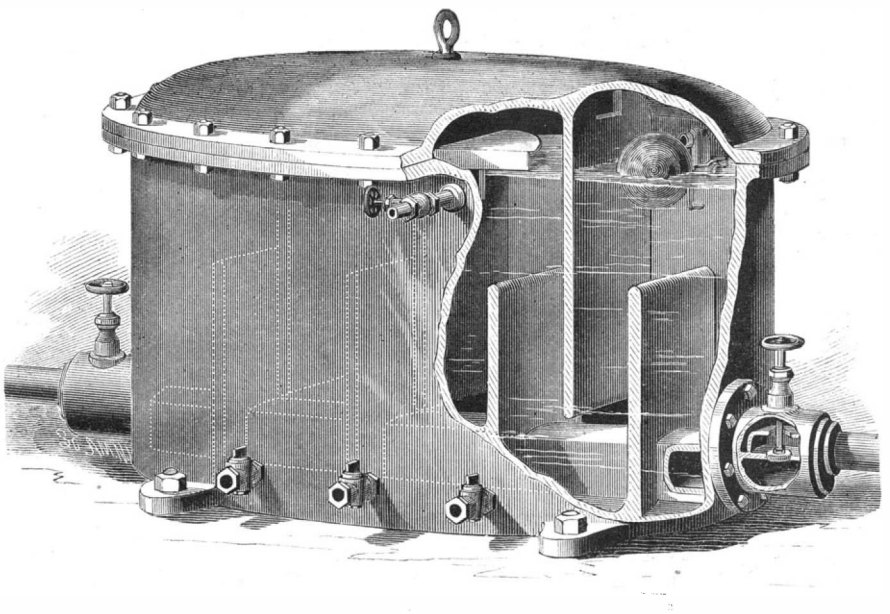
The complete manner in which the oil is extracted from the feed water is shown by the fact that steam taken direct from the main boilers where this device is applied, has been used for cooking without imparting the slightest flavor of oil, even when the engines were lubricated with crude petroleum. This is an important advantage in distilling water for drinking and culinary purposes.

This extractor is now in use on the following steamships: Walla Walla, Tallahassee, Chattahoochee, Nacoochee, Finance, and is being applied to other steamships in the course of construction.

The extractor, as shown in the engraving, consists of a vessel of suitable dimensions and strength, fitted with transverse partitions extending alternately from the top and bottom. The grease rises to the top of the water, and is removed through the oil discharge. The solid matter is precipitated, and may be removed from time to time. The air discharge valve is operated by a float as the upper part of the extractor becomes filled with air and the level of the water falls.

There are two varieties of these extractors made, one with a by-pass for allowing the water to pass around the partitions without going over and under them, the other without the by-pass. This apparatus is highly recommended by engineers who are familiar with its merits.

Further information may be obtained by addressing Messrs. Motley & Sterling, sole agents, 86 John Street, New York city.



WASS' GREASE, AIR, AND MUD EXTRACTOR.

Destruction of Ants.

A correspondent in the *Tropical Agriculturist* says: Take a white china plate and spread a thin covering of common lard over it; place it on the floor or shelf infested by the troublesome insects, and you will be pleased with the result. Stirring them up every morning is all that is required to set the trap again.

AERIAL NAVIGATION.

We give an engraving of a new flying machine, designed by Professor Baranowski, a small model of which has been repeatedly tried, we are told, with much success in St. Petersburg, Russia.

The apparatus is thus described by the *Revue Militaire*, of Paris. It consists of a great cylinder intended to have the form of a gigantic bird. The interior is provided with steam machinery, having a power proportioned to the size of the apparatus, with space for working the same; it has two lateral propellers, and one rear propeller; and their rotation determines the direction of the machine, whether it shall be vertical or horizontal; at one extremity of the cylinder is seen a species of oar which serves as a rudder; two great wings, composed of strong membranes, give an ascending motion to the apparatus, and keep it afloat in the air; the part which represents the beak of the bird is so arranged as to permit the entrance of air to the interior of the cylinder, to supply the crew and for the combustion of the fuel; the smoke, gases, and steam issue from the end, which, when the structure passes through space, will give the appearance of the tail of a brilliant comet. From the underside hangs a pendulum weight that keeps the apparatus in proper equilibrium.

In respect to the general problem of aerial navigation by flying machines, the *Engineer*, of London, makes the following observations:

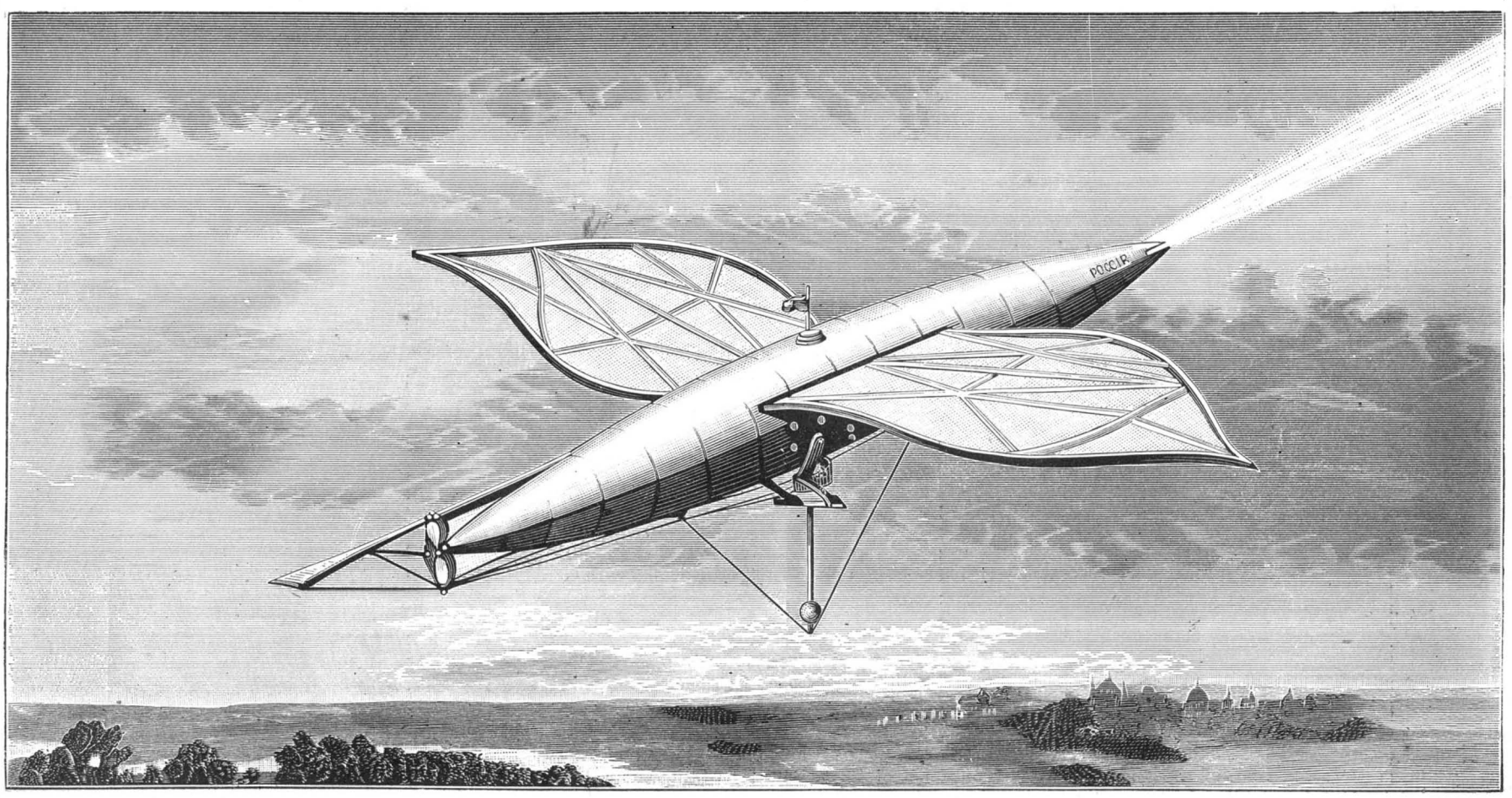
It may be urged that there is nothing mysterious about wing motion, and a simple up and down flapping will at least suffice to raise a bird in the air. Why should not men fly? The answer is that they are not strong enough. If we consider birds as machines, we see in the first place that they are all comparatively small. There is no bird of flight which weighs as much as even a very light man; but there are many birds which are far stronger than men. The albatross is, we believe, the largest—we do not mean the heaviest—bird of flight in existence. Its wings measure sometimes as much as 13 feet from tip to tip, but the total weight of the bird seldom, if ever, exceeds 28 pounds, or one-sixth that of a powerful man. But the albatross can keep its wings in motion for a whole day, while the strongest man would be exhausted if he had to keep beating the air with them for half an hour.

A great deal has been written from time to time about the effect of the wind on inclined planes in keeping birds afloat in the air. Those who have a competent knowledge of the laws of dynamics are, however, aware that the inclined plane action cannot alone keep a bird from falling to the ground. The action is at best just that of the wind on a kite; and the equivalent of the string must be provided or the bird will be carried away, just as the kite is when the string breaks. Birds, when sailing, are either going with the wind or are using up momentum acquired by previous rapid motion. The work done by the bird will vary continually; but it is strictly analogous to that of a swimmer, who, carrying a load, has to keep himself afloat by his own exertions. There is no way out of this. Nothing is got from the air in the way of help, save when upward currents strike the flying bird; and that such currents exist, every engineer who has seen the decking of a bridge lifted in a gale well knows.

Returning then to our albatross, the work it does is equivalent to continually lifting 28 pounds. The idea that the bird is buoyant in the air is a delusion. If it weighs dead 28 pounds, it will weigh living 28 pounds, and the variation in the displacement of the dead and living bird cannot represent more, at the most, than an ounce. In round numbers, 13 cubic feet of air weigh 1 pound. The albatross, therefore, represents no less than $13 \times 28 = 364$ cubic feet of air, while its entire displacement is probably at most 4 cubic feet. An increase in dimensions of one-fourth when alive as when compared with the same bird dead would represent about $\frac{1}{8}\frac{1}{6}\frac{1}{0}$ of its weight saved by extra buoyancy, which is nothing. The weight of the bird then may be regarded in exactly the same light as the weight on a brake driven by a portable engine. The brake wheel is always trying to lift it up. The power expended is measured by the distance passed over by any point in the rim of the brake wheel in one minute, multiplied by the weight and divided by 33,000 per horse power. Now, if we could tell the distance passed over by the bird's wings at each stroke, and the number of them, we should, knowing its weight, be able to estimate the power expended. We cannot do this in the case of the condor or albatross, but bearing in mind the small specific gravity of air, we shall not be very far wide of the mark if we say that an albatross probably possesses as much muscular energy as a man.

There is no engine in existence, certainly no steam engine and boiler combined, which, weight for weight, gives out anything like the mechanical power exhibited by, let us say, the albatross.

It is simply for lack of muscular power that man can never fly. There is no combination of wings or arrangements



PROFESSOR BARANOWSKI'S NEW STEAM FLYING MACHINE.

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of any kind which will compensate for this fact. Whether he can produce a machine to supplement his own want of force remains to be seen. Such a motor cannot, we think, be driven by steam. It is, however, not impossible that a machine might be made which would be caused to fly by means of a small electric motor run at a very high speed and worked by the aid of a couple of wires from the ground. This, however, would hardly be flying in the true sense of the word. That wings and such like things can be made we have no doubt; and experiments enough have been made to prove that, if power enough be available, flight can be achieved. When a machine can be made, each pound of which will develop as much energy as each pound of a bird, flying may be possible—not till then.

Decay of Building Stones.

Prof. A. A. Julien, of Columbia College, lately read an interesting paper before the New York Academy of Sciences, in which he stated that in this city 11·6 per cent of the houses have stone fronts, mostly of sandstone. The relative proportions of stones used in buildings are as follows: Brown stone, 78·5 per cent; Nova Scotia sandstone, 9 per cent; marble, 8 per cent; granite, 2 per cent; Ohio sandstone, 1·5 per cent; gneiss, 1 per cent. The number of brick buildings forms 63 per cent of the total; frame houses, 24 per cent; stone, 11·6; iron, 0·9.

The effects of weathering upon building stones has received less attention in modern times than it deserves, and very few modern buildings will last a thousand years, while many of them will be gone before their own architects are dead. In cities the weather produces a different effect on stones from what it does in the country. Marble suffers from three causes: it dissolves on the outside and is washed away, it undergoes internal disintegration, it also bends and cracks, as found by Prof. Geikie, who has studied the effect of weather upon tombstones in Scotch graveyards. Some architects have said that brown stone is no better than gingerbread to put on a house; it adds nothing to its strength, and in sixty or eighty years all the sharp corners will be rounded off. Some houses less than ten years old show signs of decay, especially where Lockport limestone was used. Lenox Library began to decay before it was finished. The time that granite will last depends on the climate. An obelisk that stood for forty centuries in Egypt, after removal to Paris was full of cracks in forty years, and probably will not last four hundred years. How long will the one last that we have imported and set up in a most exposed location in Central Park?

Nova Scotia and Ohio sandstones soon become stained and streaked, and marble sometimes crumbles on the surface so that it can be scraped off, as that in the Cathedral on Fiftieth Street.

The enemies of building stones are of three kinds—chemical, mechanical, and organic. Of the chemical agents there are the acids which dissolve carbonates, such as sulphurous and sulphuric, from combustion and from the decay of organic matter; there is carbonic acid from the air, nitric acid in summer showers, hydrochloric acid is always present near the sea, and besides these, carbolic and hippuric acids are in rain water. We do not know what there is in the air of New York city; it has never been analyzed. There must be some effect produced by the oxygen, ozone, ammonia, and sodic chloride in the air.

Among mechanical agents we have frost. In this climate there is a variation of 120° in the temperature within the year, and sometimes 70° in a day. The action of wind alone, or carrying sand and street dust, causes friction. Crystallization by efflorescence and pressure are other causes of decay, but too much stress has been put on the crushing test. Fire is another destructive agent.

Among organic agents we have vegetation on land and the marine animals in the water. John C. Draper maintains that certain lichens grow on houses in streets running east and west, but the speaker had never seen any lichens, although confervæ are quite common in this city. The influence of lichens is a point still in dispute; some say they preserve the stone, others that they injure it. A load of Italian marble sunk in our bay was destroyed by boring animals, and the piers of the Brooklyn Bridge may suffer from the same cause.

Among the internal elements of durability or the reverse is the chemical composition, such as solubility, also the influence of liquids in cavities, and as water of hydration; changes in the degree of hydration are continually going on. Also physical structure of the stone. Mica is an element of weakness. Porosity enables the frost to penetrate deeply, as often seen in the lintels and doorsteps of brown stone houses. In light colored stones, streaks form, white fluorescences, or black stains from soot, etc. Manganese also forms black stains, confervæ green ones. Hardness and crystalline structure are elements of permanence, also homogeneity. Much often depends upon the character of the surface. Smooth polished granite decays more than that which has not been polished. The position with reference to prevailing winds and rain is also an important factor.

HOW TO JUDGE OF BUILDING STONE.

Most of the tests are antique and unworthy of notice. Some idea can be obtained from an inspection of the "outcrop" at the quarry itself. Also, by examining old masonry and tombstones. Mr. Julien had examined the gravestones in Trinity Churchyard. The red sandstone, like that of which the church is built (from Little Falls, N. Y.), stood the best, and is superior to any sandstone now used in the city. The old test by dipping the stones in sodic sulphate and letting it crystallize, and repeating this twenty or thirty times, is fallacious, as it cannot be compared to frost. If dipped in water and frozen, and this repeated fifty times, the result is almost imperceptible. Other tests were mentioned, such as heating to 600° and putting in water, acid vapors, etc.

MEANS OF PROTECTION AND PRESERVATION.

1. Selection. In no quarry is the stone so good that all of it ought to be used; but it is used indiscriminately. 2. Seasoning. Wren allowed the stones he used to lie three years on the sea-beach. 3. Position in regard to its lamination. It should lie on its natural bed. 4. Shape of the projections. 5. Artificial protection, such as paints and oils. The best protection for limestones is water glass. For sandstones, it must be mixed with baric or calcic chlorides. It has been tried in some other countries, but not here. If oil is first applied, it prevents the use of water glass for ever after.

The objections made to the use of the stone, the speaker thinks not well founded, and here, where it is so abundant and accessible, it should be used much more than it is. The lecture was illustrated with lantern views.

The Scope of the Sewing Machine.

There are few conquests left for the sewing machine of the future to make in the line of variety. So various have been the uses to which our present machines have been adapted that little is left the hand needle to do. There are machines to sew the heaviest leather, and others to stitch the finest gauze or lace. Machines make button holes and eyelet holes superior to the best hand work, and at a speed that would asphyxiate an ordinary seamstress; while buttons are sewed on by modern attachments faster, in both senses, than can possibly be done by the needle with the "eye in the other end." There are overseam machines that sew carpets, others for glove work, and similar ones for fur sewing, and these leave a seam that flattens out neatly, and the stitching is as smooth and regular as can be desired by the most exacting. Other machines sew books and pamphlets, while still others, with wire for thread, sew brooms and brushes. Sewing machines with the shuttle concealed in the end of a long and slender arm sew the soles on shoes and boots with a speed and rapidity that make two pair cost less than one pair would otherwise cost, while outlasting four pair of the old fashioned ready made foot gear.

Dash machines will sew around the dash of a carriage almost in the twinkling of an eye, and such is their capacity that they will stitch to the center of an eight foot circle. Writing and embroidery of various kinds may be done on almost any of our modern machines without any attachment, and some of them will darn and patch in a manner to delight the tired mother of a houseful of romping boys. Two or more parallel rows of stitching may be done on the twin—there may be a triplet—needle machine; and one of the latest achievements of this machine is to sew the flat seam in flour bolt cloth, a feat until recently considered impossible. Cordage is sewed by machine, and so is straw braid for hats and bonnets. The scope of the sewing machine seems limited only by the variety of work the needs of mankind—and womankind—may demand. The sewing machine inventor, as a class, may soon have to sit down, as did Alexander, and cry because there are no more worlds for him to conquer. He will doubtless regret that he was not born a little earlier in the sewing machine age, before all the great inventions had been studied out and perfected. There is little left for him to do except in the direction of perfecting the present machines and cheapening their production. But even here he will find ample and profitable work for his inventive genius and mechanical skill.—*Sewing Machine Journal.*

The New Steamship Oregon.

The *Engineer* gives the following account of the Oregon, a new steamer for the Guion Line:

"It is anticipated that she will be ready for her trial trip about midsummer, and she is intended to excel in speed the fastest ship now afloat. She will not be much larger than the Alaska; but her engines are to indicate no less than 13,000 horse power. She will have but one screw, as we understand about 24 feet in diameter, with a pitch of nearly 40 feet. Steam will be supplied by 12 boilers, each with 6 furnaces 3 feet 6 inches in diameter, the grates being a little over 6 feet long. We may compare her with the Alaska, which ship has 9 boilers with 6 furnaces in each, of about the same size. Comparing grate areas, we find that the aggregate surface in the Oregon will be 1,512 square feet, divided among 72 furnaces, while that of the Alaska is 1,134 divided among 54 furnaces. As the Oregon will burn about 20 pounds of coal per square foot of grate per hour, her consumption in 24 hours will not be much under 300 tons, and allowing that each ton of coal evaporates 9 tons of water, we find that no less than 2,700 tons of steam will pass through her engines every 24 hours. A tank 100 feet square, to hold 2,700 tons of water, must be nearly 10 feet deep to prevent the water from running over the edge. If the tank were 50 feet square, the water would stand 38 feet 10 inches deep in it. If the water were supplied to a town, allowing 4 cubic feet or 25 gallons per head per day, it would suffice for a population of 24,000 souls; 6,000 tons of air will pass through her furnaces, representing a volume of 174,720,000 cubic feet through a pipe 11 feet 4 inches diameter. This volume of air would flow at the rate of 13·8 miles per hour, a strong breeze to walk against. The total weight of water evaporated on the run across the Atlantic will not be far short of three times that of the whole ship's cargo, engines and all. We give these figures to enable our readers to form some idea of what 13,000 horse power means; and we may supplement them by adding that it is equivalent to 191,517 tons lifted a foot high every minute, or the same weight lifted 1,440 feet in 24 hours. Assuming that she makes 20 knots an hour, or, omitting fractions, 2,028 feet per minute, the thrust of her screw—that is to say, the force pushing her ahead through the water—will amount to over 94 tons, or about as much as 20 of the most powerful locomotive engines in England would exert if all were pulling at her together. Among the other difficulties which crop up when we have to deal with such enormous powers as these figures represent, we mention that of getting the coal to the fires. We see that in the case of the Oregon no less than 300 tons a day, the full load for a coal train of 30 trucks, will have to be handled every 24 hours. If the ship were at rest, the problem would not be easy of solution, but it becomes very hard indeed to deal with in a rolling and pitching vessel. All is done, of course, that can be done in arranging boilers and bunkers to accommodate each other, but it is evident at a glance that out of a total quantity of, say, 2,500 tons of coal a great deal must be stowed at a considerable distance from the furnaces. It does not appear that any mechanical device has yet been hit on in the way of a railway which answers better than the existing arrangements, by which the whole of the work is effected by sheer manual labor."

Enlargement of the Suez Canal.

The Works Committee of the Suez Canal have adopted a programme of improvement works requiring several years to carry out, and estimated to cost 23,000,000 francs.

The improvements involve rectification of the west bank of the channel of the outer port of Port Said; formation of a new basin at Port Said; widening of the canal in the passage of the small Bitter Lakes; widening of the canal between Suez and Kilometer 152; doubling of the Ismailia station; embankment of Kantara station, and of the station of Kilometer 133; rectification of the eastern curve of Timsah station: also of the southern curve of the small lakes; also of the northern curve of El Guisr; also of the curve of Toussoum; widening of the canal off Port Tewfik; deepening of the basin of Port Tewfik; and the annual continuance of the masonry work.

The committee think these works will be adequate for the doubling of the present traffic, or 10,000,000 tons. In anticipation, however, of a still greater increase, they think it will be expedient, at a date which cannot be yet fixed, to take into consideration the idea of the cutting of a second channel, parallel to the present one. Such a second channel, definitively meeting all future exigencies, would involve negotiations for obtaining, besides the compensations foreseen, the land for such a channel, and for the enlargement of the stations and ports.

Dyeing with Aniline Black.

To produce a black that will not turn green the Swedish Vanadium Company publish the following simple process in the *Industrie Blatter:* 1,250 parts of white starch and 420 parts of dark scorched starch are boiled in 5,500 parts of water, and after it has cooled to 122° Fahr., 800 parts of aniline oil and 800 parts of hydrochloric acid (specific gravity 21° B.) are added. When the mixture gets cold, 420 parts of sodium chlorate and 500 parts of boiling water are added. At the time of using it, but not a moment sooner, 200 parts of a vanadium solution are poured into this mixture. The goods are left in this bath for *two* days, and then passed through a solution of potassium bichromate (half per cent), warmed to 158° Fahr., and next soaped as usual.

Instead of adding the hydrochloric acid in these proportions, it is still better to neutralize the aniline drop by drop until a few drops of the liquid impart a greenish blue color to a very dilute solution of Paris violet (1 in 1,000).

The vanadium solution is prepared by dissolving 10 parts of vanadiate of ammonia in 40 parts of dilute hydrochloric acid at a gentle heat, adding some glycerine, and then boiling until the solution has acquired a deep green color and all has been dissolved. It is then diluted with water until it equals 1,000 parts, and preserved in well closed vessels.

The Use of Liquid Carbon Dioxide.

A. W. Hofmann has called attention to the extensive use of liquid carbon dioxide for various purposes. The gas is condensed and sold by F. A. Krupp, of the world renowned iron works in Germany. It is used mostly to compress steel castings in closed moulds. It is placed in wrought steel vessels which hold 100 kilos of the liquefied gas. A pressure of 800 atmospheres is obtained. In Krupp's works all the ice is manufactured with the aid of a machine which is kept constantly at work by compressed carbon dioxide. A large quantity of soda water used in the same works is made from liquid carbon dioxide. One of the most interesting applications of the compressed gas has been recently made in Berlin in connection with fire engines. Each engine is supplied with a large vessel containing the liquid. This is brought into use as a motor the instant the engine arrives at the place of the fire, and some of the gas is thrown with the water upon the flames. As soon as sufficient pressure of steam is obtained, the use of the carbon dioxide is stopped.—*Berichte der deutsch. chem. Gesellschaft,* xv. 2668.

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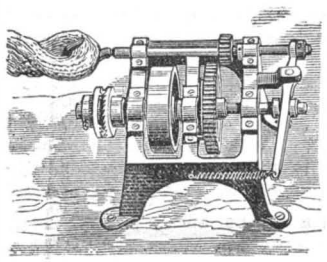
RECENT INVENTIONS.

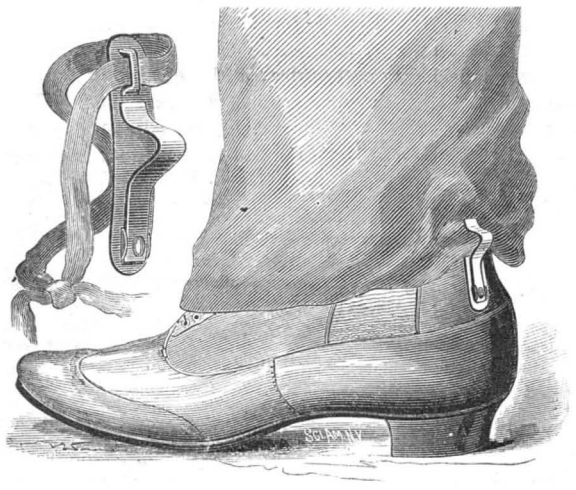
Yarn Hanking Machine.

The engraving shows an efficient little machine for hanking all kinds of yarn and twines. It does its work rapidly and with uniformity. Two shafts are journaled in a suitable frame; one of them carries the hanking hook, and is provided with a pinion and a spring-acted clutch lever, which moves the shaft lengthwise in its bearings when the hanking hook is relieved. The driving shaft carries a sleeve on which is mounted the driving pulley. The shaft moves endwise in the sleeve, and carries at one end a clutch capable of engaging a serrated collar on the end of the sleeve, and at the other end a grooved collar engaged by the spring-acted clutch lever. The driving shaft carries a gear wheel capable of engaging the pinion on the hook shaft when the latter is moved endwise by a slight pull on the hank. The gear wheel carries a stud in one side which is engaged by a stop attached to the frame, and stops the hook with its point upward or outward whenever the pull on the hook is released. The pulley on the driving shaft revolves continuously, and when a hank of yarn is placed on the hook and pulled slightly, the pinion is brought into engagement with the spur wheel, and the clutch at the end of the drive shaft is brought into engagement with the notched collar on the sleeve, when the hook is revolved, quickly twisting the hank. When the hank is released the gearing stops and the operation may be repeated. This invention has been patented by Mr. John F. McAfee, of Pleasant Hill, Mo.



New Pantaloons Protector.

The engraving shows a simple and inexpensive device for holding up the legs of pantaloons to prevent them from being injured or soiled by dragging in the mud in bad weather. The invention consists in a plate having a curved spring attached to it by a rivet, and having formed in it a loop, which is offset so as to allow a tape or strap to pass straight through it. The tape is the only fastening required to keep the device in place on the ankle. The construction



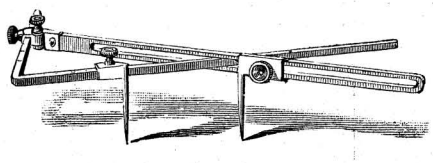
Pantaloons Protector.

of the fastener is clearly shown in the detail view, while the other view shows the manner of applying it. The tape is tied around the ankle, and the hem of the pantaloons is placed under the spring. This device is very quickly applied and removed. It obviates the necessity of turning up the pants, and effectually supports them so that they will not touch the walk or the ground.

This invention has been patented by Mr. Charles J. McDermott, P. O. Box 84, Sandy Hook, Conn.

Instrument for Ascertaining the Draught of Moulding Cutters.

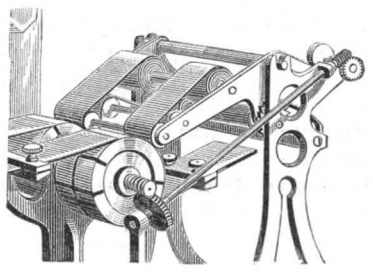
Mr. Granville M. Drummond, 42 to 48 West 13th Street, New York city, has recently patented an instrument for laying out the cutting edges of moulding cutters, so that they will cut a moulding of the desired pattern. The device consists in an angle bar provided with a slide, to which an arm is pivoted, the latter being provided with a slide having a pointer. The angle bar is also provided with a slide carrying a pointer, and by means of the two pointers the height



of a member of the moulding is measured, and then the end of the arm and the end of the bar are separated until the angle bar rests against the slide of the arm. The distance between the pointers will then be the required draught of the cutter at the points corresponding to the certain member of the moulding. The slides are provided with binding screws to hold them in position after being adjusted. This instrument not only saves a great deal of time, but insures accuracy.

Lubricator for the Commutators of Dynamos.

This apparatus is for lubricating the commutators of dynamo electric machines to prevent the brushes from cutting into the commutators. The invention consists in a rocking frame provided with rollers to which bands saturated with oil are attached and with other rollers over which the bands pass. One of these rollers, to which the bands are attached, is provided with a ratchet wheel with which a fixed pawl spring engages, which rotates the roller when the frame rocks, thus winding the bands from one roller to the other, so that a fresh surface of the bands will come in contact with the commutator every time the frame rocks. The frame is rocked by an eccentric wheel operated from the dynamo shaft. This invention has been patented by Mr. Levi P. Dollison, of Wabash, Ind.



Krao, the "Human Monkey."

Through the courtesy of Mr. Farini, I have had a private interview with this curious little waif, which he is now exhibiting at the Royal Aquarium, Westminster, and for which he claims the distinction of being the long sought for "missing link" between man and the anthropoid apes. Krao certainly presents some abnormal peculiarities, but they are scarcely of a sufficiently pronounced type to justify the claim. She is, in fact, a distinctly human child, apparently about seven years old, endowed with an average share of intelligence, and possessing the faculty of articulate speech. Since her arrival about ten weeks ago in London, she has acquired several English words, which she uses intelligently, and not merely parrot fashion, as has been stated. Thus, on my suddenly producing my watch at the interview, she was attracted by the glitter, and cried out *c'ock, c'ock,* that is, *clock, clock!* This showed considerable powers of generalization, accompanied by a somewhat defective articulation, and it appears that her phonetic system does not yet embrace the liquids *l* and *r*. But in this and other respects her education is progressing favorably, and she has already so far adapted herself to civilized ways that the mere threat to be sent back to her own people is always sufficient to suppress any symptoms of unruly conduct.

Physically, Krao presents several peculiar features. The head and low forehead are covered down to the bushy eye brows with the deep, black, lank, and lusterless hair characteristic of the Mongoloid races. The whole body is also overgrown with a far less dense coating of soft black hair about a quarter of an inch long, but nowhere close enough to conceal the color of the skin, which may be described as of a dark olive-brown shade. The nose is extremely short and low, with excessively broad nostrils, merging in the full, pouched cheeks, into which she appears to have the habit of stuffing her food, monkey fashion. Like those of the anthropoids her feet are also prehensile, and the hands so flexible that they bend quite back over the wrists. The thumb also doubles completely back, and of the four fingers, all the top joints bend at pleasure independently inward. Prognathism seems to be very slightly developed, and the beautiful round, black eyes are very large and perfectly horizontal. Hence the expression is on the whole far from unpleasing, and not nearly so ape-like as that of many Negritos, and especially of the Javanese "Ardi," figured by me in *Nature*, vol. xxiii, p. 200. But it should be mentioned that when in a pet, Krao's lips are said to protrude so far as to give her "quite a chimpanzee look."

Apart from her history, one might feel disposed to regard this specimen merely as a "sport" or *lusus naturæ*, possessed rather of a pathological than of a strictly anthropological interest. Certainly isolated cases of hairy persons, and even of hairy families, are not unknown to science. Several were figured in a recent number of the Berlin *Zeitschrift für Ethnologie*, and, if I remember, both Crawfurd ("Journal of an Embassy to Ava") and Col. Yule ("Mission to the Court of Ava") speak of a hairy family resident for two or three generations at the Burmese capital. This family is reported to have come originally from the interior of the Lao country, and in the same region we are now told that little Krao and her parents, also hairy people, were found last year by the well known Eastern explorer, Mr. Carl Bock. Soon after their capture, the father appears to have died of cholera, while the mother was detained at Bangkok by the Siamese Government, so that Krao alone could be brought to England. But before his death a photograph of the father was taken by Mr. Bock, who describes him as "completely covered with a thick hairy coat, exactly like that of the anthropoid apes. On his face not only had he a heavy, bushy beard and whiskers, similar in every respect to the hairy family at the court of the King of Burmah, who also came from the same region as that in which Krao and her father were found, but every part was thoroughly enveloped in hair. The long arm, and the rounded stomach also proclaimed his close alliance to the monkey form, while his power of speech and his intelligence were so far developed that before his death he was able to utter a few words in Malay."

Assuming the accuracy of these statements, and of this description, little Krao, of course, at once acquires exceptional scientific importance. She would at all events be a living proof of the presence of a hairy race in further India, a region at present mainly occupied by almost hairless Mongoloid peoples. From these races the large straight eyes would also detach the Krao type, and point to a possible connection with the hairy straight eyed Aino tribes still surviving in Yesso and Sakhalin, and formerly widely diffused over Japan and the opposite mainland.—*A. H. Keane, in Nature.*

Aid of Machinery to Labor.

Labor is a natural burden upon humanity; yet it is the key which unlocks the storehouse of wealth, convenience, and luxury. By the use of invented and applied machinery muscular work is greatly relieved, and results cheaply and extensively obtained. In all this, however, intelligent skill is not supplanted; but rather there is a wider field created for the same, and more and more does it come into demand as the facilities for production multiply. Man, of course, may exist as our forefathers did, living in a rude and limited way on the necessaries of life, and even these secured only at the expense of oppressive toil; but as improvements are made, and varied and enlarged benefits flow therefrom, he rises in the scale of being, and the sphere of life is extended. The easy supply of want in any direction only begets efforts in others; and as matters thus progress, instead of the demand for useful industry being diminished, there is more and more inducement to laborers to employ themselves with the exercise of every faculty.

It is a mistaken view, therefore, to imagine that there is the least tendency in the use of machinery to supersede the necessity of workmen, and take from them all opportunity to labor. Their skillful hands, discerning eyes, and intelligent brains are surely destined to find an ever widening field. Of course, the worker must not remain stationary, content to live and die an antiquated fossil, while all the world about him is changing and progressing. What he once did painfully and slowly with the hands alone he must now more abundantly accomplish through the agency of labor-saving devices and tools. Society has need of more production, and will only be satisfied with even more and more. With its prosperity and progress the laborer shares; and to-day he has more of the comforts and luxuries of life than were enjoyed by kings a hundred years ago. The prejudice against improvement, and the jealousy against capital and associations in their efforts to manage and direct production into more efficient and beneficial channels should disappear. As changes occur, old ruts should be promptly abandoned. By adapting himself to circumstances as they are thrust upon him, there is not a man who cannot succeed and find a market for his labor far beyond his ability to supply.—*Dubuque Trade Journal.*

New Iron Bridge over the Yazoo River.

The Memphis, Vicksburg, and New Orleans, or what is better known as the Wilson line of railroads, is now building quite a large iron bridge over the Yazoo River, some twelve miles above Vicksburg, Tenn. The construction of the piers for the bridge has been vigorously prosecuted for some time past. The point selected is unusually difficult and expensive for the construction of a bridge, as there is no bed rock or other material within reach for the foundations to rest upon, and the river, even at low water, is nearly 40 feet deep.

The bridge will consist of three spans about 300 feet long each, two of them fixed spans, and the third, a draw span, located in the middle of the channel. These will be some 6 feet above the level of extreme high water, and slightly above the elevation of the banks on either side. There will be five piers, one at each end on the bank and three in the river. To obtain the requisite supporting capacity, piles—100 in the pivot and 72 in each of the other two channel piers—are driven to a depth of 40 feet into the river bottom. The outfit to drive these piles consists of a regular pile driver engine, with a 4,000-pound hammer, a Skinner steam hammer weighing 7,000 pounds, and a large duplex Worthington pump to supply a water jet, when this can be used in place of driving, or to assist the latter. When the jet can be used to advantage, pipes are so arranged that one or more powerful jets are brought into play at the point of the pile, excavating a hole for this latter to sink into. The caisson for the first pier is 50 feet in diameter, with sides 2 feet thick and 6 feet high; the roof consists of solid timber and is 7 feet thick.

The piers, when complete, will consist of piles sawed off level with the bottom of the river. Surmounting these is a solid platform (the roof of the caisson) of timber 7 feet thick, on which will rest the piers proper, which will be one continuous mass of concrete. The cost of the entire structure is estimated at from $225,000 to $250,000.

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ENGINEERING INVENTIONS.

A novel apparatus for hoisting and dumping ores, etc., has been patented by Mr. John C. Dougherty, of Sedgwick, Col. The invention consists in a bucket or box, of semi-cylindrical form, hung in a truck frame, and held to the track by guide rollers. The frame of the bucket is provided with handles for propelling it upon the level track, and it is so arranged as to adjust itself to the track without the liability of spilling its contents. The improvement is intended for use at mines for elevating the ore upon inclined shafts, and for hoisting or moving other materials, either upon level or inclined tracks or upon vertical ways.

A steam rock drill of considerable novelty has been patented by Mr. Simon Ingersoll, of Stamford, Conn. The invention consists in a steam rock drill constructed with the way plate that carries the steam cylinder connected by bolts having L-heads and bearing blocks with a sleeve, to the ends of which the side legs are connected by universal joints, that the steam cylinder and the legs can be readily adjusted in any desired position. Within the steam chest two valves are attached to the outer ends of two levers, the inner ends of which are connected by an equal armed lever. The valve carrying levers are so arranged that the valves will be operated at the proper times by the movements of the piston.

An improved railroad switch has been patented by Mr. Charles F. A. Eddy, of Greenfield. Mass. The invention consists of a latch and spring contrivance with the switch bar and switch rail, whereby the spring will set the switch for main line automatically when detached from the latch of the switch bar; and also of devices by which the latch may be detached by the flange of the pilot wheel of the locomotive, to enable it to be set for main line by the spring in advance of the wheels, when the locomotive is running along the main line from rear of the switch. It also consists of a contrivance whereby the attachment on the locomotive will unlatch the switch, either way the locomotive may go, at the will of the engineer, thus insuring safety to the train.

MECHANICAL INVENTIONS.

An improvement in sewing machines has been patented by Mr. Luther E. Higby, of Brattleborough, Vt. The invention consists of improved combinations of parts, for an adequate explanation of which engravings would be necessary.

A thread card holder for sewing machines has been patented by Mr. Gustav Wicke, of Barmen, Prussia, Ger., which consists in a device for holding cards on a sewing machine in such a manner that this card can rotate freely to permit the thread to unwind from the same as it is used.

Mr. William L. Roberts, of Ellenton, S. C., has patented a machine for drawing and edging shingles, constructed in such a manner as to taper the shingles uniformly and upon both sides from butt to point, take the twist out of the timber, and make the side edges of the shingles straight at one passage of the shingles through the machine.

Mr. Julian Lane, of Moss Run, O., has patented an improved churn. The object of the invention is to provide simple means for securely holding churn bodies of different diameters upon the frame; and it consists of an adjustable and hinged holder extending transversely across the base frame, and adapted to securely hold churns of any diameter or height during the operation of churning.

An improved wet gas meter has been patented by Mr William Mackintosh, of Callao, Peru, S. A. The invention consists in certain novel features of construction, having the object to secure correct and unvarying measurement of the gas at all times without regard to the change in the water level, and also to furnish a meter that shall not require to be charged with water except at long intervals.

A novel snap hook for holding rings has been patented by Mr Francis A. Hake, of Cuero, Tex. The invention consists in a hook provided with a sliding latch on the shank and on the end of the hook, whereby the hook will remain closed in whatever position it is placed; and also in sliding bolts and sliding sleeves on the shank and on the end of the hook, whereby double latches will be formed on the end of the hook and on the shank.

A device for facilitating the insertion of dredging buckets into sand, clay, or other hard and resisting substances has been patented by Mr. William H. Wood, of New York city. The invention consists in a dredging bucket having double sides and ends, forming water spaces in the ends and sides, into which spaces water is forced by a suitable pump when the bucket cuts into the bottom, which water issues from the openings of the water spaces and loosens the bottom.

A novel device for tightening the bands of elliptical springs has been patented by Mr. William Wallace Bruce, of Western Port, Md. The invention consists in a box in two parts or dies, constructed to receive the spring in between them, and having the opening for such purpose arranged obliquely to the closing line or plane of motion of the dies, whereby the pressure put upon the band is equal on all sides and instantaneous, and the whole accomplished in a simple, rapid, and effective manner.

An improved apparatus for converting motion has been patented by Theophilus Sargent, of Hallowell, Me. This invention relates to the lever contrivance for producing rotary motion by means of a couple of toothed segments on the lever working loose pinions on the shaft, which alternately gear with it by ratchets and pawls, one going forward and turning the shaft, while the other is going backward to the starting point; and the invention consists of a stopping and reversing attachment to be applied to the above.

An improved bending machine has been patented by Mr. Lindsay B. McNutt, of Ashtabula, O., which has for its object the bending of buggy shafts, carriage poles, pole bars, etc., the apparatus being arranged to be operated by steam or compressed air or by hand. The essential feature of the invention consists of a former and attachments wherewith a pair of carriage shafts or couple of poles, pole bars, or other like pieces of carriage or wagon stock may be secured by one set of apparatus and be bent at the same time.

An improved invalid bedstead has been patented by Mr. John Baggs, of Baltimore, Md., and it is especially adapted to the wants and convenience of invalids. The occupant of the bed may be raised easily by an attendant and supported in a sitting or reclining posture; the same may be readily attached to or detached from common bedsteads, and the lower extremities of the occupant may be supported in a raised position for the convenience of the attendant or surgeon, or for relief to the occupant by change of position.

An invention which consists in an improved cut out for systems for electric lighting employing either arc or incandescent lamps has been patented by Messrs. Charles F. Coleman and Henry A. Smith, of Atlanta, Ga., the object of which is to avoid the liability of warping and the burning of the cut out and connecting wires, which is a great objection to cut outs as heretofore made. In this improved device the lamps are cut out without breaking the circuit, so that the current has a continuous unbroken connection without the aid of springs or switches to convey the current.

A safe of novel construction for use on ship board has been patented by Mr. David W. Smith, of Port Townsend, Washington Ter. The invention consists in a safe which is cheap as to cost compared to other burglar and fire proof safes, simple in construction and operation, waterproof and buoyant, burglar proof while on board ship, and fireproof. Free itself to float from a sinking ship without assistance, to keep afloat for an indefinite time until washed ashore or picked up, and to preserve its contents from loss by sinking or injury by water, and endure being thrown upon a rocky coast without breaking. The inventor claims all these advantages for his new invention.

A fire engine of simple construction, light weight, and easy transportation has been patented by Mr. Lyman H. Zeigler, of Redkey, Ind. The invention consists in a pump pivoted in a frame mounted on a U-shaped axle supported on wheels, whereby the axle can be swung upward, so that the pump and frame will be raised during transportation; or the axle can be swung downward, so that the frame rests on the ground and forms a firm bearing for the pump during operation. The frame is provided with a tongue or pole for pulling or pushing the engine, and with pivoted braces for locking the parts in position when the axle is raised.

AGRICULTURAL INVENTIONS.

Mr. Michael Kite, of Prairie Township, Jackson Co., Mo., has patented a novel sulky plow, an improvement upon patent No. 251,895, granted to the same inventor on Jan. 3, 1882. The present invention consists in a double hinge coupling for sulky plows, constructed with a clamp to hold the plow beam, and connected to the draw bail, whereby the plow beam will firmly control the sulky and prevent side draught, while at the same time it will have free lateral and vertical movement.

Mr. Mark Vasbinder, of Warren, O., has patented an improved seeding machine, the object of which is to provide a practical and efficient seed sower having such construction that it shall be adapted to sow all kinds of grain and grass seed with equal facility and to enable grass or clover seed to be sown in windy weather. The invention consists of a seed box divided into compartments for the distribution of the grain, of an agitator which is kept in motion by a pawl and ratchet combination, connected with the wheel of the vehicle, and of proper conduits and spouts for the scattering of the grain in an even manner.

MISCELLANEOUS INVENTIONS.

Mr. Edward Squires, of Portland, Ore., has patented a novel fifth wheel, which consists of half circle plates, one having its straight portion provided with an apertured lug fitting in a socket in a sleeve formed upon the straight portion of the other plate, combined with a tubular bracket bolted to the axle and the king bolt.

An improved wagon box has been patented by Mr. Eugene F. Chapman, of Wilson, Neb. The invention relates to improvements in the end boards of wagon boxes, and to the means for attaching them to the box and holding them in place for closing the ends of the box; also to separate side and end boards for enlarging the wagon box.

A fowl fetter, the invention of Mr. Sanford J. Baker, of West Waterville, Me., has recently been patented. A metallic collar is fastened around the leg of a mischievous fowl, to which are attached wire spurs of considerable length. This collar is beveled at the edge to prevent chafing of the manacled leg of the disobedient fowl, who is thus restrained from doing damage about the premises.

Mr. John J. Kimball, of Naperville, Ill., has patented an improved churn. The invention consists in a box, through the diagonally opposite corners of which passes a bar or axle ending in a crank, and to which is attached internally two circular blades at right angles to one another, which are rotated by means of the crank without. A breaker is placed in the corner of the churn, which greatly facilitates the process.

An improved wagon seat spring, the object of which is to provide light, strong, cheap, and elastic springs for carts and wagons, has been patented by Mr. Montillion H. Cassiday, of Wakefield, Va. The invention consists of a narrow strip of steel, the ends of which are curved over in the form of a C, to which extremities is attached the seat. The straight portion of the spring is provided with pendent legs for use in attaching it to the wagon body.

An improved compound for preserving eggs, by which it is claimed they may be kept for nine months, has been patented by Mr. Bernard L. Castor, of, Wilber, Nebr. It consists of the following ingredients: fresh slaked lime, one pint; salt, one pint; Portland cement, sometimes called "water lime," one ounce; white glue, one-half ounce; water, three gallons; all of which must be thoroughly stirred in the water, care being taken that the eggs, when inserted, are well covered by the compound.

An improved coffee urn has been patented by Messrs. Louis F. Duparquet and Pierre Huot, of New York city. The object of the invention is to facilitate the removal of the receiver for the decoction from the water tank of a coffee urn. For this purpose the receiver is provided with a flange adapted to rest on the rim of the water pot, which is provided with an inwardly projecting flange that rests upon the flange of the decoction receiver.

Mr. Vital Bessier, of New York city, is the patentee of a novel fire escape, which consists of a folding ladder combined with the shutter frame of the window. A strong shutter frame of either wood or iron is hung upon strong hinges capable of supporting, in addition to the shutter, a ladder, and the weight of persons who may have occasion to use it. The ladder is folded into the shutter frame, so that the appearance of the fire escape is not objectionable.

A novel device for holding coins of various denominations has been patented by Mr. George W. Rowley, of Caledonia, Wis. The invention consists in a coin holder formed with a plate having recesses for receiving and means for securing the coins therein, a flanged cover hinged to the same, connected with which are spring strips having their ends provided with tongues for holding the coins in place. Joined to the lower end of the plate or cover is a pouch or bag for receiving bills or foreign coins.

An improved fabric for boots and shoes, which is at once warm and easy for the feet, preventing the drawing action of rubber, has been patented by Mr. Henry E. Urann, of Providence, R. I. A sheet of cork is first affixed to canvas or other material suitable for backing, and in turn cemented or otherwise secured to the material of which the boot or shoe is made. This fabric is not only employed for the upper or leg part of the boot, but likewise for the sole.

Mr. Camille Poirier, of Duluth, Minn., has patented an improvement in pack straps. The invention consists in a bag formed with a flap and provided with shoulder straps and a head strap for supporting and carrying the bag on the back. Sliding pads are provided on the shoulder straps, which are united by a transverse strap. A socket for the purpose of holding an umbrella or sun shade over the head of the traveler is also attached to the sack.

An improved sign consisting of a frame with a transparent plate set in it, with letter color or gilt on its inner face, and a filling applied on its front face to form margins for letters, has been patented by Mr. Frank E. Munn, of Dallas, Texas. Instead of employing a single strip of glass for the ground work of all the letters, separate pieces are employed for each letter, so that in case one piece should be broken it will not be necessary to insert glass for all the letters of the sign, but simply for the broken or defaced ones.

Messrs. Isidor and James French, of New York city, have patented an improved necktie. The invention consists in a band bow neck tie constructed with a bow provided with a shield recessed and slotted to receive the collar button, and having a band holding pin attached to it. A separate band is provided with an eye plate at one end to receive the collar button, and at the other end with a scale to facilitate the adjustment of the band to the size of the collar upon which it is to be worn.

An improved invalid bedstead has been patented by Mr. Isaac D. Johnson, of Kennett Square, Pa. It consists of a combination whereby a portion of the bed may be elevated so as to bring the invalid into a semi-sitting posture, this being accomplished by a system of ropes and pulleys which the invalid can operate himself without the aid of an attendant. The invention possesses other devices for the comfort of invalids, and seems to have many advantages over the invalid bedsteads now in common use.

Mr. Goldsborough Robinson, of Louisville, Ky., has patented an improved process of and apparatus for moistening leaf tobacco. The invention consists in subjecting the tobacco in a chamber to a blast of moist air and by the blast returning the air partly deprived of moisture from the tobacco room to the vapor room, and so on continuously, until the tobacco is moistened sufficiently for work. This is a great economy over the old method, in which so much of the steam was lost.

An improvement in lanterns whereby is obviated the necessity of soldering the lantern to the bottom of the light chamber has been patented by Mr. William Porter, Jr., of New York city. The invention consists in securing the bottom of the light chamber to the base of the lantern by means of a three-ply flange, which more firmly secures the parts together than when solder is employed, and at the same time forms a three-ply stiff internal flange, better adapted to support the springs of the lamp than the two-ply flange ordinarily employed.

An invention in merchant's shelf box for facilitating the inspection of goods has been patented by Mr. Benjamin F. Robinson, of New York city. The invention consists in such a manner of construction of the box that the side pieces confine the goods in the box only at one end, so that the outer ends of the pieces are left free to be raised for inspection upon both sides and turned back, one off from the other, for exhibiting the varieties. When the box is closed it protects the goods from dust, saving the goods from the wear and damage incident to frequent handling.

An improvement in saw filers has been patented by Mr. Harvey P. Jones, of Winterset, Ia. The invention consists of devices in combination with a clamp for holding the saw and a frame for carrying the file to gauge the depth, pitch, and inclination of the teeth; and it also consists of a contrivance of the file frame, whereby the file is made to run with a rising and falling guide, on which its frame rides from end to end of the range of the file, so that the curved edge of the file acts uniformly on the saw the whole length of the file.

A compound for coating the inside of vessels which are intended to contain butter, lard, oils, beer, wines, liquors, or mineral waters, which is insoluble by any of these liquids, and at the same time impermeable to fluids, has been patented by Mr. Edgar G. Frisbie, of Monroe, Mich. It consists of the following ingredients: For every gallon of this compound is used shellac, one pound; beeswax boiled in alcohol, one-half pound; whiting in alcohol, one-fourth pound; and alcohol sufficient to make up the gallon. The mixture may be applied to the vessel on the inside like any paint or liquid by means of a brush.

A novel railroad signal has been patented by Mr. David C. Baughman, of Albion, Ind. The invention consists of a lantern, two sides of which are furnished with bull's eyes, and the other two sides with signal wings, the whole being mounted upon a rotary carrier or table, so arranged that by means of a cog wheel it may be rotated so that the position of the signal in relation to the track may be changed. The axis turning the cog wheel passes through the tubular arm supporting the signal and carries a grooved wheel on its further end, which may be turned by means of a chain or rope connecting it with the ground or with the signal station.

A device called a sand band, for preventing sand, dust, and water from passing into the space between the axle and the axle box in a hub, has been patented by Mr. John Schoellkopf, of Tidioute, Pa. The invention consists in a cup shaped ring, mounted loosely on the axle between the inner end of the hub and a collar on the axle, which ring is provided with an external shoulder, between which and the collar a spiral spring surrounds the axle, and presses the ring against the hub. The ring is provided with an annular flange having notches through which studs pass, which project from the collar on the axle and prevent the ring from rotating with the hub.

A novel oil pail, designed to provide a new and improved receptacle for oil, which can be filled easily, and from which the oil can be drawn readily, has been patented by Mr. John W. Collier, of Lockport, N. Y. The pail, one portion of which is left flat, so that it may be hung against the wall, has an opening in the top to facilitate the filling of the pail, which opening is provided with a stopper, and a strainer, to prevent dirt from entering the pail. It is also provided with a tube and vent valves, connected with the faucet for admitting of air while drawing or filling. The pail is coated on the inside with a solution of glue to prevent the oil from entering the wood.

An ingenious device for a lantern has been patented by Mr. David C. Baughman, of Albion, Ind. The invention consists in a false top forming an air space in the upper part of the lantern, from which the air is conducted to the lamp by downwardly projecting air tubes. The invention also consists in an exterior and an interior chimney in the upper part of the lantern, which chimneys are covered by a cowl provided with a side opening and a weather vane, whereby the air inlet and outlet can be covered and the wind prevented from passing through the opening of the cowl, by which device the air as it reaches the lamp flame is warm and the brightness of the light increased.

An improved water lac varnish for finishing wall paper and for similar purposes has been patented by Mr. George H. Beck, of New York city. The composition consists of the following ingredients, combined in about the proportions stated, viz.: ammonia, one hundred and forty grammes; shellac, 907·15 grammes; water, five thousand grammes; gelatine, one hundred and thirty-two grammes; glycerine, sixty grammes. When the varnish is ready for use, it may be applied by rollers or by a grounding machine, and will give the paper an even, rich, and waterproof leather finish, furnishing a surface that may be washed with warm or cold water.

The object of the invention of Mr George Baum, of Arbon, Switzerland, is to provide an improved device for holding the bodkins or stilettos of an embroidery machine in such a manner that they can easily swing into position when required, and out of position when not required for use. The invention consists in a tube held in swinging arms on the needle-rail of an embroidery machine, on which tube clamp rings are held, to which the bodkins are attached. The invention also consists in stop rings held on the tube adjoining the clamp rings, which stop rings have side projections on which the bodkins rest when in position for operation.

An invention, the object of which is to provide a new and improved vessel for packing butter in such a manner that it will remain fresh and sweet, and will be protected from the action of the air, has been patented by Messrs. John J. Carey and Patrick Cavanaugh, of La Salle, Ill. The invention consists in a jar provided with an inner and outer cover, resting on packing rings, and held on the jar by means of clamps passed over a circular ridge on the outer cover The clamps are provided in their lower hooks with rubber blocks, resting with their upper edges against the lower edge of an external collar of the jar, which collar is provided with beveled recesses. By moving these clamps out of the recesses and along the edge of the collar, the outer cover will be held and pressed on the jar and its packing rings.

An appliance for galvanizing or coating fence or other wires with metal has been patented by Mr. Henry Cull, of Johnstown, Pa. The invention consists in two chambers connected by a pipe or tube, one of which is to be heated and supplied with metal for galvanizing until the melted metal shall have flowed into and nearly filled the second receptacle, which must be kept hot also. The wire, after being properly treated with acid, is passed through a pipe arranged for the purpose, and up through the top over an apparatus for coiling, which gives the wire a steady and continuous motion through the metal. As the liquid metal in pipe and receptacle is being gradually taken up by the wire, more is gradually flowing in from the receiving pan, which must be supplied from time to time as it runs low. By this arrangement the addition of cold metal has so little effect upon the temperature of the metal at the point where it is applied to the wire, that the coating is at all times light, even, and smooth.

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Business and Personal.

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The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

Common Sense Dry Kiln. Adapted to drying of all material where kiln, etc., drying houses are used. See p. 78.

The Sweetland Chuck. See illus. adv., p. 78.

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Drop Forgings. Billings & Spencer Co. See adv., p. 45.

For Pat. Safety Elevators, Hoisting Engines. Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 44.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423. Pottsville, Pa. See p. 46.

Improved Skinner Portable Engines. Erie, Pa.

Contracts taken to Manuf. small goods in sheet or cast brass, steel, or iron. Estimates given on receipt of model. H. C. Goodrich, 66 to 72 Ogden Place, Chicago.

Steam Pumps. See adv. Smith, Vaile & Co., p. 29.

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First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street. P. O. Box 3083, New York city.

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 62.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

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Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) E. M. H. asks: 1. Is there any difference between the effect of quantity and intensity currents upon an electro-magnet? A. Yes; quantity currents are adapted to coarse wire magnets used on short circuits. Intensity currents are adapted to fine wire magnets and circuits of high resistance. 2. What proportion should the size of the core bear to the number of coils to get the greatest effect? A. In general, the winding should equal the core in thickness. 3. Should a larger gauge wire be used for an intensity current than for a volume current when wrapping a magnet? A. See reply to first query.

(2) Ph. L., Brazil, writes: Please let me know through your columns a good recipe for preparing fish for export—canned, smoked, and salted. Will extraction of air from tins prevent putrefaction? A. See SUPPLEMENT, No. 320.

(3) A. M. W. asks how to take the lime out of the water for use in boilers. The water is very hard and alkaline. A. Dr C. F. Chandler says, in his report on "Water for Locomotives, and Boiler Incrustations," that barium chloride decomposes calcium sulphate (sulphate of lime), forming barium sulphite, which is deposited; barium carbonate is sometimes used, but these are, perhaps, too expensive, and hence catechu, nutgalls, oak bark, shavings and sawdust, tan bark, tormentilla root, mahogany, logwood, etc., are recommended. These substances contain tannic acid, which is extracted by the water, and forms a basic calcium tannate (tannate of lime) that separates out. The use of the aqueous extract of these substances is the best on account of avoiding mechanical obstructions liable to occur in the use of chips, sawdust, etc. An incrustation powder composed of sawdust, 70 parts; barium chloride, 15 parts; ammonium chloride (sal ammoniac), 10 parts; is good, but perhaps too expensive.

(4) C. H. L. writes: I have in my parlor a chandelier made in imitation of bronze. The bronze has worn off, and consequently gives the chandelier a whitish gray appearance. Is there not a paint or stain by which I can rebronze it? A. All dealers in artist's colors sell bronze powders and bronze or gold paint, which will answer your purpose.

(5) H. G. L. asks: 1. Could a Ruhmkorff induction coil have a wooden bobbin on which the insulated wire is wound? A. Yes. 2. Would it be better to coat this bobbin with shellac? A. Yes. 2. Is there any article in the SCIENTIFIC AMERICAN or SUPPLEMENT which relates to induction coils? A. See SCIENTIFIC AMERICAN SUPPLEMENT, 160.

(6) B. T. B. asks: 1. Should the resistance of the field magnets in a self-exciting dynamo be equal to that of the armature? A. No; it may be more in some cases and less in others. 2. If the resistance of the armature in a low tension machine be such a small fraction of an ohm, how can the resistance of the field be the same, and yet have enough wire to magnetize sufficiently? A. In this class of machines the resistance of the magnet exceeds that of the armature. 3. Is there any advantage in having long magnets, as on the Edison machine? A. Yes. 4. I want to make a Gramme machine with ring core, outside diameter 3½ inches, and 2½ wide, wound with four layers No. 18 wire, making resistance of armature about one ohm. What size and quantity of wire would be best for field? A. Use six or seven layers of No. 16. Better make a larger machine. It will cost no more, and will give better satisfaction.

(7) G. L. G. says: Can you tell me of any gum or article of any kind that can be applied in a liquid form to fill the openings of wire cloth, so as to make a partially transparent sheet which will stand the weather? My idea is to obtain a substitute for glass in hot bed sash. A. Possibly gelatine may answer, in following proportions: Water ounce, gelatine ounce; bichromate of potash. The latter renders the gelatine insoluble.

(8) W. C. & Co. ask: What is the best way to burnish tin? We have a foot lathe capable of making 600 to 900 revolutions per minute. A. Tin can be burnished in the same way as with silver, viz., with a polished steel burnisher and soap water. It is also planished with polished hammers in the process of manufacture; but these are tedious processes for ordinary ware. A revolving brush and wet whiting or chalk will be more appropriate for your work. Some use a buff wheel of wood covered with felt, where the surfaces are large and plain. Buff or brush crosswise, so as not to streak the work. For a final finish a soft cotton cloth and dry Vienna lime gives a fine luster.

(9) F. E. G. asks: 1. In which of two cases will a wire wear the least and run with the least friction in turning a right angle—to make the turn around one wheel 7 inches in diameter, or to run around two wheels of 3½ inches to make the turn? A. The wire will work better and last longer running over the larger wheel. It is sharp bending around the small wheels that soon breaks the wire; besides, in using two wheels to make a turn, the wire is bent and straightened twice in making the turn. 2. Are there any pearls found in the oysters of this country? A. Pearls are occasionally found in the common oyster; they are of no value.

(10) V. T. asks: Will salicylic acid prevent cooked fruits or preserves and jellies from souring or moulding? Is there anything better than salicylic acid to keep preserves and jams from spoiling? A. Salicylic acid will answer your purpose. Prof. Kolbe says "that the preserving power of salicylic acid will be greatly increased by adding a small proportion of potassium bisulphate and potassium chloride; these will prevent the salicylic acid from combining with the phosphates contained in the substance, thereby losing its efficiency." Benzoic acid is considered, according to Watts' 3d Sup., to be more powerful as an antiseptic than salicylic, boracic, or formic acids.

(11) J. C. asks: 1. Of what is printer's varnish made that is used to thin ink, and the amount of each ingredient used in a pint? A. Either resin or linseed oil. 2 What is used for a "drier"? A. Manganese borate. 3. How can job ink be made indelible? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 157. 4. How can it be made to give a glossy appearance? A. Job ink cannot be made glossy, except by the subsequent application of varnish.

(12) J. E. A. writes: I am in want of information in regard to the best manures for orange growing in the soil of Florida. A. SUPPLEMENT, 227, contains "Florida Orange Culture;" SUPPLEMENT, 242, "Cheap Manure for Gardens;" SUPPLEMENT, 177, "Agricultural Plant Feeding;" SUPPLEMENT, 171, "Homemade Superphosphates;" SUPPLEMENT, 186, "How to Make a Poor Soil Fertile." Dealers in fertilizers furnish pamphlets on this subject.

(13) G. F. asks: How can I wash or erase printed matter from paper? A. Use plenty of naphtha or benzol, or strong hot caustic soda or potash solution (in water).

(14) S. H. J. asks: 1. How to make those small pellets known as serpent eggs, which, when ignited, form themselves into long masses or cylinders. A. Potassium dichromate, 2 parts; potassium nitrate, 1 part; white sugar, 3 parts. Pulverize each of the ingredients separately, and then mix them thoroughly. Make small paper cones of the desired size and press the mixture into them. Also, see SUPPLEMENT, 250. 2. How can I make a brilliant black ink? A. The addition of sugar will give a gloss to the ink. For receipts, see SCIENTIFIC AMERICAN SUPPLEMENT, 157.

(15) R. V. J. asks: 1. What is the effect of burning salicylic acid in atmospheric air? A. There would result from the combustion of salicylic acid in air, carbon dioxide and water. From the general properties of nitrogen, we should infer that its presence would have no effect upon the combustion. With nitrous oxide, a decomposition of the latter would result. Nitrous oxide is one of the most stable of the oxides of nitrogen, and we presume it could be kept for some time without its becoming decomposed, providing, of course, that it was kept away from the air. 2. Can protoxide of nitrogen be confined in closed vessels for a length of time without change? A. Yes.

(16) R. B. C. asks: 1. After the sand is packed around the pattern for casting, how is the pattern taken out without breaking the mould? A. Use a flask that divides through the middle, and place the pattern in the flask, so that every part shall have a taper from the dividing plane; or, if the pattern be properly made and itself divided, mould one-half upon a board and in a half flask, then turn the flask over and place the other half upon it, and the half of the flask in its place. Then sift a little powdered charcoal upon the sand in the side made up. Then finish the mould and separate the flasks and take out the patterns, after rapping it a little one way and the other. We recommend you to visit a foundry before you commence. 2. What kind of a crucible should I use for melting brass, and where can I obtain such? A. Use a black lead crucible. Such crucibles are sold by all dealers in metallurgists' supplies. 3. At what temperature is brass fusible? A. Brass melts at 1,900°.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. M. W.—Sample *a*. Hornblende. Sample *b*. Contains two small brown paper packages, one containing iron pyrites with quartz gangue, the other, darker, is similar with an iron oxide gangue. They may carry gold, which can only be determined by assay. One large specimen of hornblende showing small crystals and crystalline structure. Several specimens of quartz with pyrites, possibly gold bearing. One specimen of brownish quartz with small crystals; and also smaller specimens of hornblendic gangue without any apparent definite mineralogical character. Sample *c*. Limonite, hydrated sesquioxide of iron. Sample *d*. Quartz containing pyrites—probably carrying gold.—C. H. D.—The mineral sent is calcite, a calcium carbonate. If it contains phosphorus, it would be of value for fertilizers; from its appearance we would infer that it does not contain sufficient of that constituent to make it desirable.—C. J. S.—Iron pyrites, iron sulphide probably carrying gold.

COMMUNICATIONS RECEIVED.

On Vital Force Developed in Hatching Eggs. By H. S.
On the Tides. By C. W. T.
On the Sun. By J. T. R.
On Fire Escapes. By P. T. S.
On the Chemistry of the Galvanic Current. By W. H. G.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

January 23, 1883,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications, not being printed, must be copied by hand.

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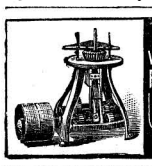

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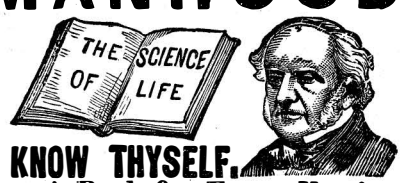

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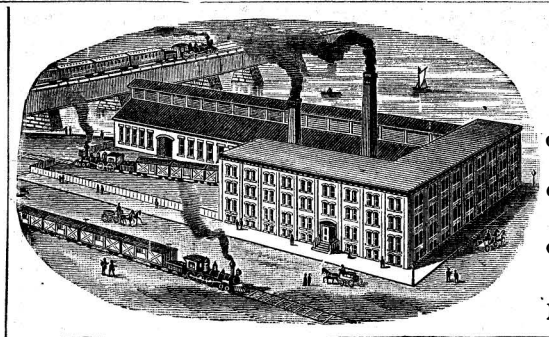

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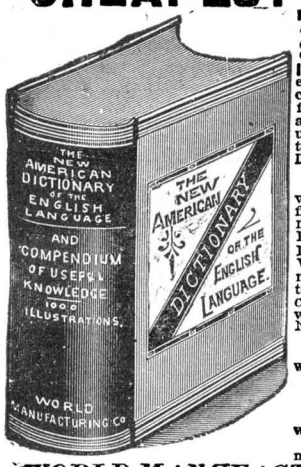
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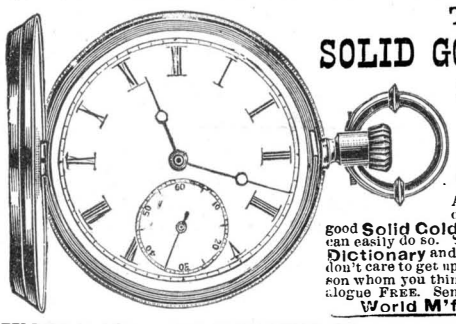

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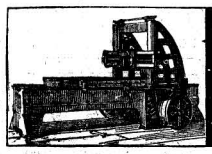

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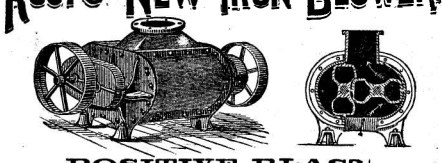

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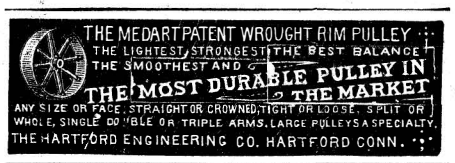
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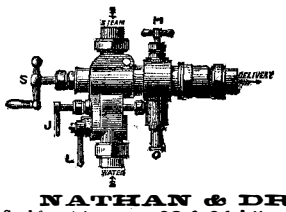

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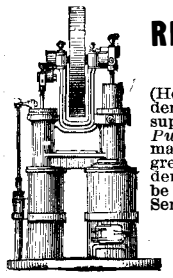

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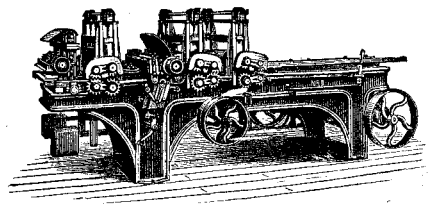

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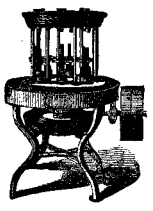

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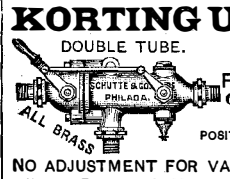

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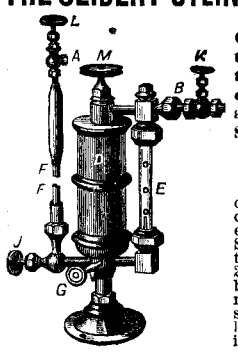

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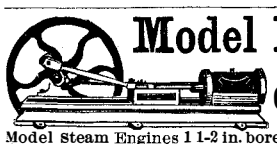

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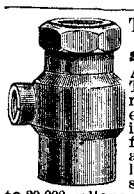

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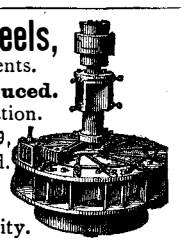

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